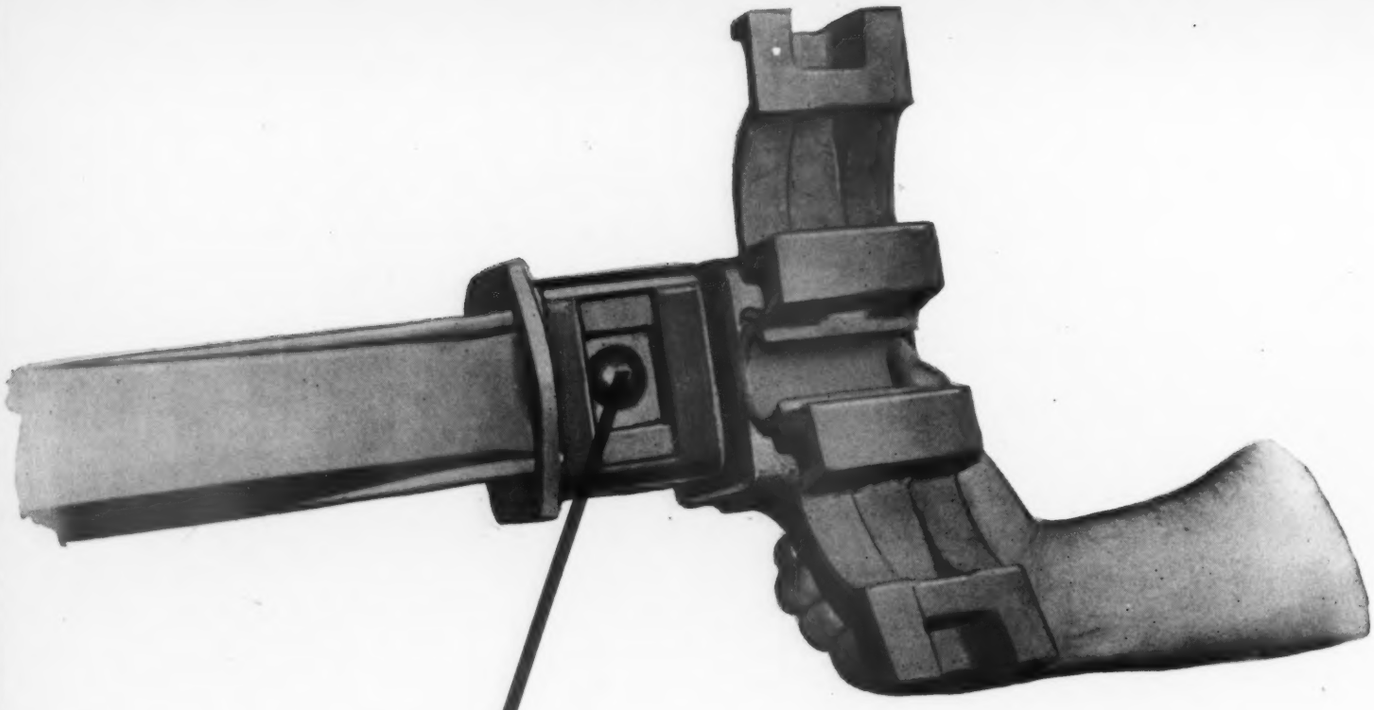
RAILWAY
SEPTEMBER, 1951

Mechanical and Electrical Engineer



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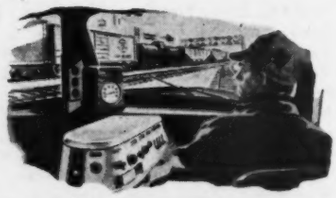

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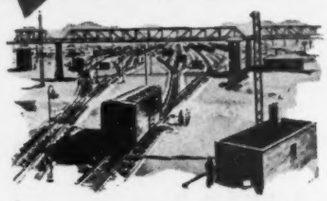

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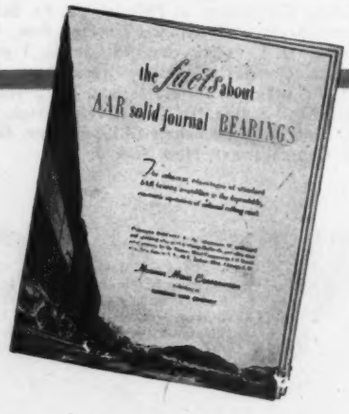

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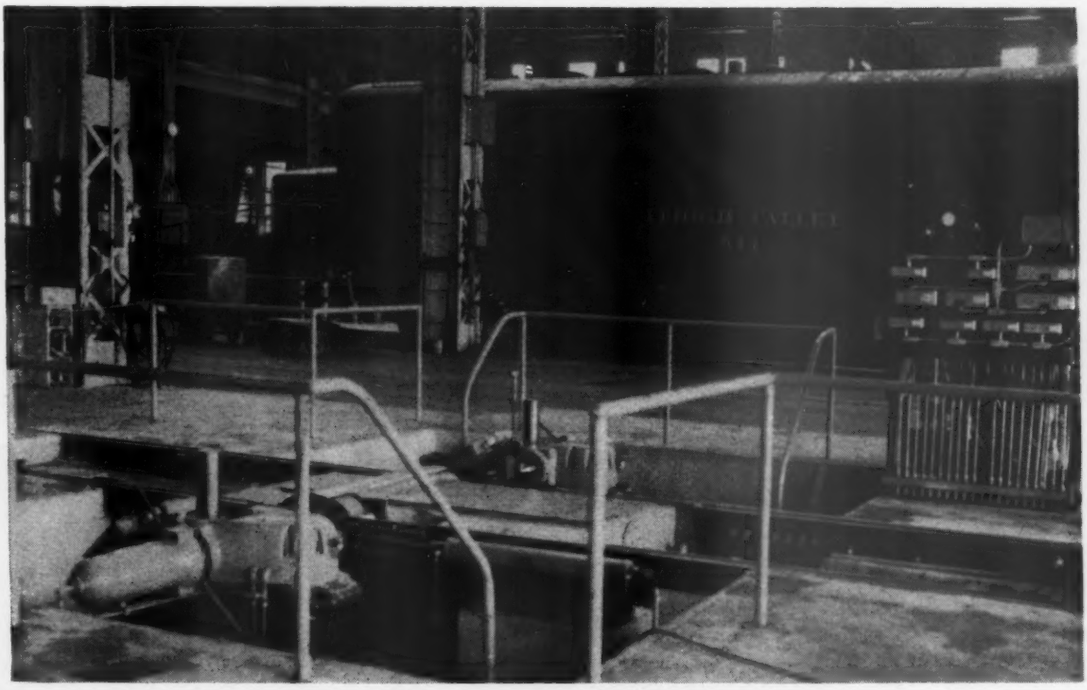


The Lehigh Valley's diesel wheel-truing machine is located in a pit adjacent to the servicing platforms at Sayre

How the Lehigh Valley Keeps Diesel Wheels in Trim

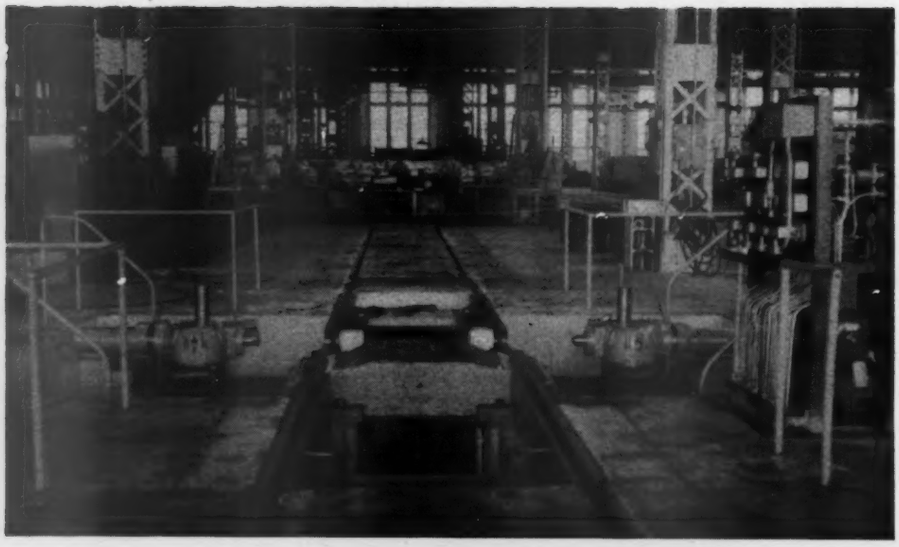
THE Lehigh Valley is turning its diesel locomotive wheels "on the hoof" by use of the wheel-truing machine developed and produced by the Standard Railway Equipment Manufacturing Company. All diesel wheels with defects that require attention, except those that must be removed because they are worn to the condemning limit, are reconditioned during periodic inspections of the locomotives at the road's Sayre, Pa., shops without dropping the wheels or removing the truck. Although the wheel-truing machine has been in service less than three months it is known that substantial direct savings are obtained which will amortize the machine's cost in at least 5 years and probably much earlier. In addition the wheel work does not tie up the diesel units for unscheduled shop repairs or interfere with normal maintenance work, as routine work may be continued while the wheels are being turned. Scheduled operating assignments of the locomotive are not affected.

Direct savings include the man-hours saved in drop-pit time for removing and replacing the wheels and truck and for the removal and assembly of the bearings as well as the man-hours and machine time required to move the wheels to wheel shop and then set up and turn the wheels. The machine also eliminates the additional maintenance frequently needed when truck assembly is disturbed.

This machine is the second of its kind to be installed; the first one was developed over a three-year period at the Joliet, Ill., shops of the Elgin, Joliet & Eastern. The latter was described on page 464 of the August, 1950, issue. A third is ready for installation on the Southern Pacific at Roseville, Cal., and two have been ordered by an eastern railroad.

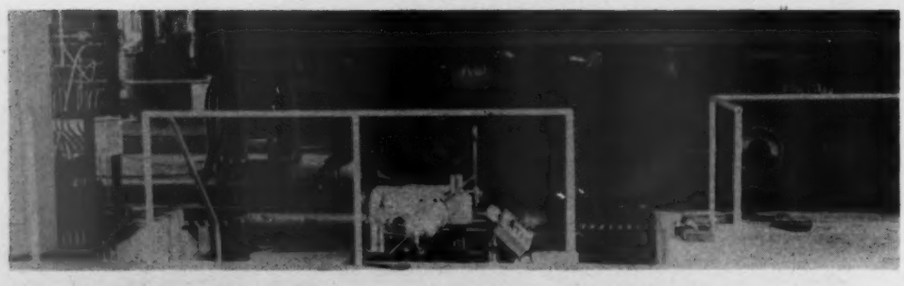
The machine at Sayre has a few small but important differences from the "guinea pig" machine at Joliet. A V-type driving roller contacts each wheel flange and turns the pair of wheels during the machining operation, replacing a knurled roller which imprinted objectionable knurl marks on the wheel flange. The cutter has ten instead of eight cutting blades with 11 cylindrical carbide inserts in each, making a total of 110 cutters in the contoured cutter body. The arrangement used to raise the wheels being turned on the drive mechanism and lock the adjacent pair of wheels in the truck has been changed to utilize a simple wedge mechanism.

At the Sayre shops a wheel inspection is made of each diesel road unit as it comes in for routine servicing and



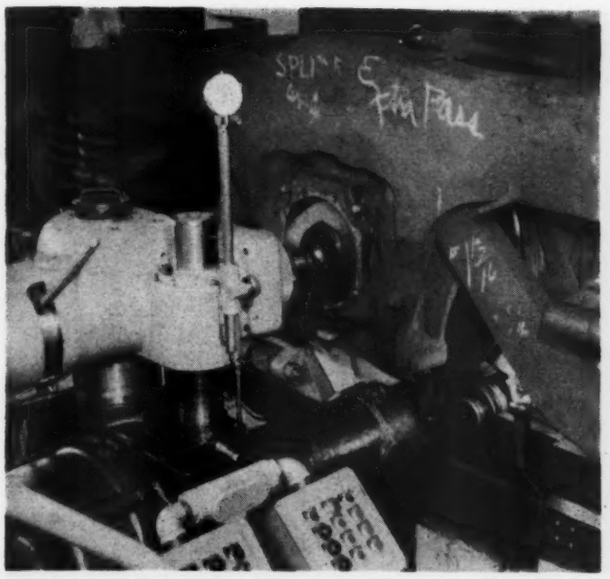
With the rail sections at the machine open, the V shape driving rollers may be seen

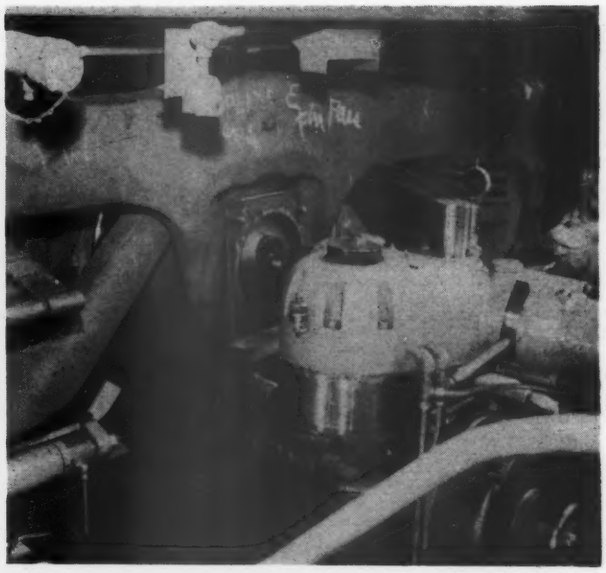
The machine is in a lowered position with the rails in place ready for the spotting of a diesel unit. Duplicate push-button controls are on each side of the track



The roller-bearing journal-box covers of the 2,000-hp. diesel passenger unit spotted at the machine have been removed from the two pairs of wheels to be turned. Removal of the covers is the only preparatory operation required

A diesel unit at the machine ready for wheel turning. The machine has not yet been raised to its operating position



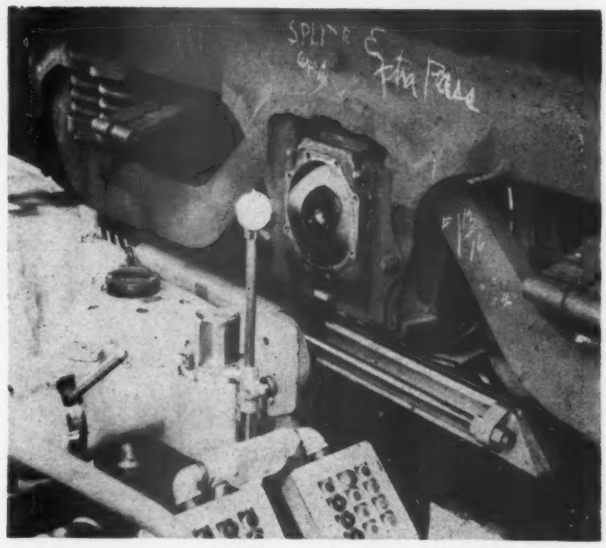


Above: Taking a cut. The contour milling cutter is seen directly under the wheel. Left: The diesel wheel is resting on the driving roller. Wheel centers are out. The dial gage and controls are in the foreground.

maintenance work. Sharp or high wheel flanges, slid flat spots, and other conditions requiring attention on each unit are spotted at this time. As the wheel-truing track is located adjacent to the servicing platforms each unit needing wheel work can be easily shunted over to the wheel machine. In the event that the diesel unit is scheduled for service before the wheels can be turned, and wheel condition permits a delay then the wheels are scheduled for turning at the next regular inspection.

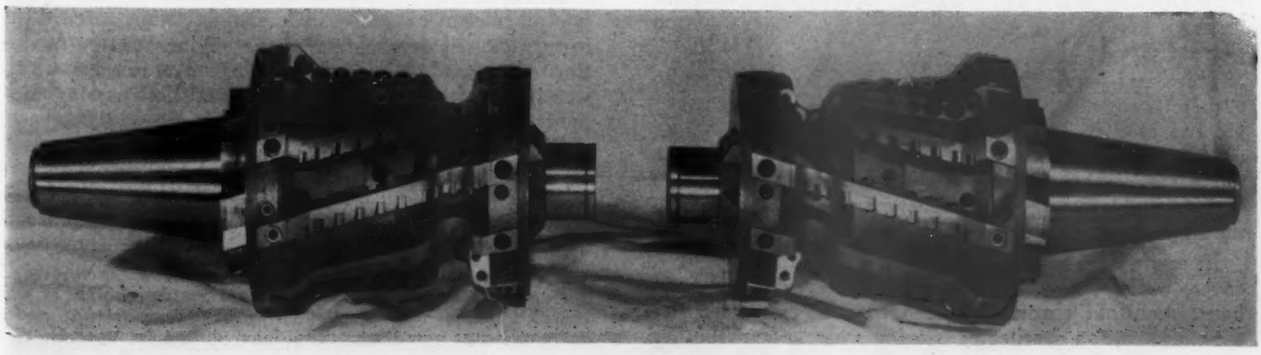
The Lehigh Valley only turns those wheels needing attention. The unit shown in the accompanying illustrations, a 2,000-hp. Alco-G.E. passenger unit, had two pairs of wheels reconditioned at the time the photographs were taken. Each cut taken on the wheel requires 19 minutes of cutting time on a 40-in. wheel. Normally, a ¼-in. or 5/16-in. cut is taken per revolution of the wheels; the number of cuts needed to bring the wheels to the correct contour varies with the wheel condition. Both wheels on each pair are machined to the same dimensions simultaneously as the tailstock centers hold the wheel pair in position and the cutting tools are located to gage. The machine is operated by one machinist and an apprentice, although one man can handle the electrical and hydraulic push-button controls when necessary.

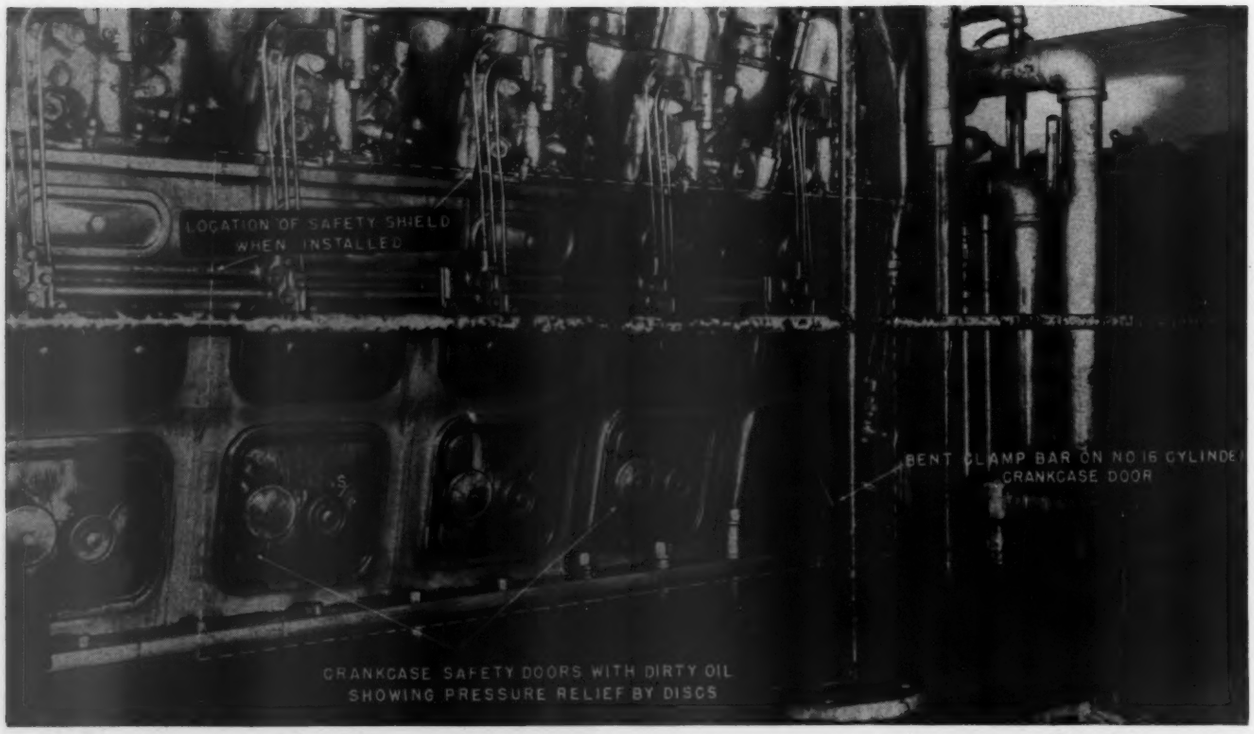
An interesting use of the wheel machine was the removal of flat spots from most of the cars in the Lehigh Valley's "Black Diamond" passenger train after an emergency stop was made to prevent an accident to this train. Although not designed primarily for car work, the cars were back in service within 48 hours.



The wheel-truing machine in lowered position with the rail back in place for movement of the locomotive

The contour cutters have 110 cylindrical carbide inserts that may be rotated as the cutting edges become dull. Each insert is located .0001 laterally from the insert in the adjacent row





Crankcase Explosions and How To Limit the Damage

Damage can be greatly reduced by preventing the second of two rapidly occurring steps which comprise the typical explosion

CRANKCASE explosions occur for the same reason that waste paper ignites when a match is touched to it—a combustible material is raised to its ignition point. Similarly, the ideal way to prevent crankcase explosions is just as simple. Just build, maintain and operate diesel engines so that there never develops any overheating sufficient to reach the ignition temperature of the contents of the crankcase.

This ideal solution is not yet within close reach despite strenuous efforts on the part of diesel builders and maintenance men in the railroad and in other fields where diesel power is employed. A brief review of some of the more serious explosions that have occurred illustrates how varied and complex the factors which contribute to the basic cause are in practice.

In one of the simpler cases to assess, all the top deck covers were blown off and the underside paint of the exhaust manifold shroud blistered for the entire length; the cause was an overheated bearing with no contributing defects. In another explosion caused primarily by an overheated bearing, blow-by from two cylinders was considered a contributing factor.

Dirty lube oil caused a third explosion in two ways. It resulted in frozen rings and a galled piston and liner; sediment in the oil clogged the filter and the consequent low oil pressure resulted in inadequate lubrication. This in turn caused overheating of the engine and the formation of a combustible mixture in the crankcase which was ignited by the products of combustion passing over the frozen rings on the defective piston.

Piston difficulties were the root of trouble in two other explosions. In one, an overheated and broken piston permitted entry of fuel oil vapor into the lower crankcase and interrupted the lube oil supply to the wrist pin and

The illustration at the top of the page shows the results of a crankcase explosion which occurred on an engine at the Naval Experiment Station due to a blower seizure under extraordinary operating conditions during a special test

the associated main bearing. The overheated piston or the bearing then ignited the combustible vapor in the crankcase. In the other case, one piston and its rings were defective, and the compression rings on six of the other pistons were stuck or broken. This condition permitted unburned fuel to blow by and enter the air box, forming an explosive mixture in the air box, which was ignited by the flame blowing by the defective piston.

Add together the direct causes and the almost infinite number of possible combinations of circumstances that can lead to crankcase explosions and it can be seen that their complete elimination is not easy, nor is it likely in the foreseeable future. The most desirable alternate solution to the problem is, therefore, to keep to a minimum the damage that results from those explosions that do occur.

Minimization of this damage appears most likely to be attained through mechanical design. Little or nothing can be done from a lubricating oil or fuel oil standpoint to prevent crankcase explosions so long as inflammable lubricants are employed.

Two papers presented at the June meeting of the Oil and Gas Power Division of the A.S.M.E. dealt with the causes of crankcase explosions and how to limit the resulting damage, and information contained in both of these papers is included in this article. One paper was by A. C. Cavileer, head of the large diesel engines branch of the U.S. Navy Internal Combustion Engine Laboratory of the engineering experimental station at Annapolis, Md. The second was by G. W. Ferguson of the Texas Company.

Explosion Is in Two Phases

Both papers agreed that the problem of minimizing the damage from crankcase explosions boils down to preventing what technical experts in the diesel field refer to as the *secondary* explosion. This is the explosion that automatically and quickly follows the initial, or *primary*, explosion. It is not related to any second explosion that might take place as a result of starting too soon an engine that has been shut down because of one explosion having occurred.

Why the secondary explosion is responsible for most of the damage to equipment and most of the injuries to personnel in the overwhelming majority of cases, and why this secondary explosion occurs, can be seen by tracing the steps involved in a typical crankcase explosion.

First of all, a source of heat above the minimum ignition temperature of the contents of the crankcase must be present in the crankcase. In the great majority of explosions, this heat is furnished from an overheated part, such as a seized piston or an overheated bearing, although there are other possible sources that have been reported, such as "flame-torching" through lined-up cylinder ring gaps.

This source of heat ignites the mixture of oil mist and air in the crankcase, causing the *primary* explosion. This may occur with or without any outward signs of trouble. In many cases operating personnel are forewarned of the approaching danger by large clouds of white smoke issuing from around the crankcase doors or by excessive engine vibration and noise.

The mixture which is ignited comprises air plus mechanically atomized oil droplets and perhaps vaporized petroleum products produced by the lube oil coming in contact with the overheated parts. Depending upon the air-fuel ratio, the ignition source, the shape and size of the enclosure, and other factors, a primary explosion occurs. This varies in intensity from a puff of white smoke to a severe explosion. Usually, all the factors do not occur just right to produce the more violent explosion.

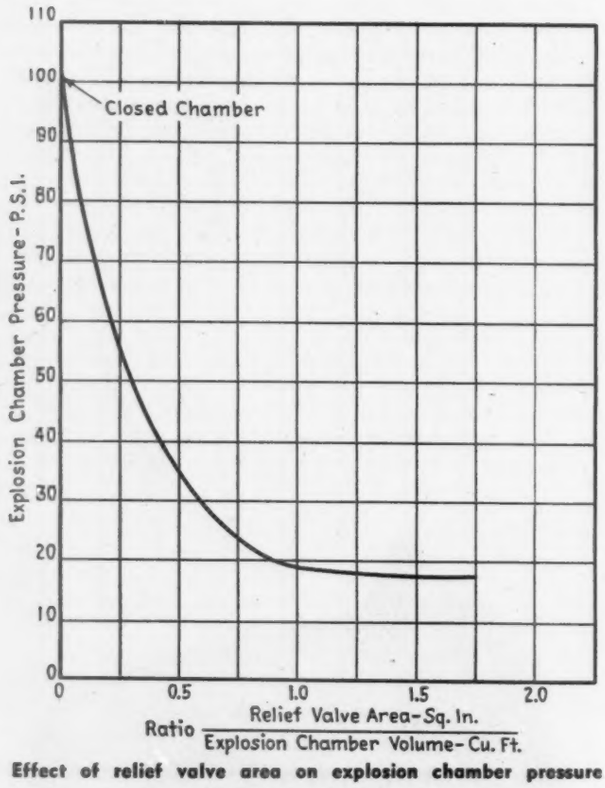
If, at this point in the cycle, in the case of the more violent primary explosions, the crankcase can be vented to the atmosphere through adequate openings, excessive pressure will not build up in the crankcase. However, when the expansion and escape of the gases due to the pressure and energy of the explosion are finished, the gas in the crankcase contracts and pulls a fresh supply of air into the crankcase. This inrush of air can furnish the necessary oxygen for the secondary explosion.

If the engine is equipped with relief openings which close immediately after the primary explosion, the engine can possibly be stopped in time to prevent any following explosions. Gasket or frangible-diaphram-type release valves, however, provide only for the relief of the primary explosion, and do not prevent the inrush of the fresh air. Fresh air is likewise free to rush in when relief of the primary explosion is by a crankcase door blowing off or by some part of the crankcase rupturing.

The greater severity of the secondary explosion can be

Failed clamp bar of a door blown off the navy test tank during a test in which the maximum explosion pressure seldom exceeded 16 p.s.i.

Crankcase door with spring-loaded plates to relieve excess pressure gave good results



Effect of relief valve area on explosion chamber pressure

explained by the change in the richness of the oil mist and air mixture. The primary explosion occurs in a relatively rich and slow-burning oil-air mixture. The inrush of fresh air caused by the cooling of the primary explosion gases provides sufficient oxygen to form a leaner and more explosive mixture for the secondary explosion.

An interesting phenomenon following the primary explosion and tending to prevent the secondary explosion has bee observed in a number of cases. The door which was blown off the crankcase was at the end of the engine opposite from the cause of the explosion. This is thought to be the result of the pressure in the crankcase increasing as the pressure wave progresses along the length of the crankcase. The secondary explosion did not occur because, as the gases contracted, the burned, oxygen-depleted atmosphere receded toward the closed end and thus prevented fresh oxygen reaching the hot spot.

How To Limit the Damage

The U.S. Navy has underway a series of tests for the purpose of learning how best to be able to contain the explosions that do occur and to limit as much as possible the effects of crankcase explosions and the fires which sometimes follow. The program includes the testing and development of adequate crankcase covers for all types of engines commonly used in the Naval service that are known to be subject to crankcase explosions. It includes also tests on two-cycle engine air box covers as this problem is similar. The tests were divided into two categories:

1. Test of explosion relief type doors designed to relieve the initial explosion pressure and thereafter to seal the crankcase from the inrush of fresh air which follows the explosion.

2. Test of plain type doors to withstand the pressures of the crankcase while other relief means are operating to prevent excessive pressure rise in the crankcase.

Results of the test showed that several otherwise satisfactory crankcase door installations were ineffective in providing protection against explosions. The most serious deficiencies were the method of securing the door to the engine, and the method and material used for the gasketing between the door and the door opening.

The set up for the test comprised an explosion chamber equipped with the crankcase door to be tested. Because the gas composition that exists in a crankcase was impossible to reproduce exactly, a mixture of chemically pure propane and air was used. Propane was selected because it has the highest rate of flame propagation of all the paraffinic hydrocarbons and should give as high or higher an explosion pressure than would be encountered during a typical crankcase explosion. The necessary measurements and steps were taken to insure a correct mixture of the propane and air in each test. A Maihak diesel engine cylinder pressure recorder with the drum driven by a belt from a motor was used to record combustion pressure. Ignition of the charge in the tank was by spark plug, and high-speed movies were taken of the test.

The first test on several makes of doors dramatically disclosed what could happen when a severe crankcase explosion occurs.

Due to the weak construction, the strongback would buckle and collapse, and the door would fly violently from the test tank followed by considerable flaming gas and slam into the sand bag rebuttment. Concussion from the explosion was severe; in one case nine panes of window glass were broken. No one would be safe anywhere in the vicinity of the engine where he could be struck by one of the doors or close enough to be burned by the flames which followed.

Surprisingly enough, the explosion measure recorded during an explosion when a door was blown off seldom exceeded 16 p.s.i., giving a total force on the door of approximately 1,800 lb.

What Relief-Type Doors Can Do

Several styles of relief type doors were developed and tested, and the results on two types were the most significant. The first type of door had spring-loaded plates to relieve the excess pressure.

The results on this type door were quite satisfactory. When an explosion occurred, the relief plates opened and permitted the gradual escape of the explosion gases and prevented a build-up of excessive pressure. No violence or concussion accompanied the explosion, the only sign of which was a moderate sound similar to escaping air pressure. The recorded pressure was approximately 20 p.s.i.

It was found desirable to provide retainer rings for flame protection and to use good cementing technique for the cork gaskets on the plate because of the tendency of the explosion to blow the gasket from the plate or to burn the edge and face of the gasket.

A graph was plotted to show the explosion chamber pressure for different ratios of relief-valve area to crankcase volume. From this it was concluded that it is desirable to have approximately 1.5 sq. in. of relief valve area for each cubic foot of crankcase volume.

The second door tested provided maximum gas escape area by being held onto the engine frame with a spring loaded strongback. Explosion pressure was relieved by lifting the entire door off the opening.

Results of this test were disappointing because, despite adequate relief of pressure and ability to reseat prop-

erly, the door was awkward to handle, too heavy, and when it did relieve an explosion, the concussion was severe. The flame present when the door lifted was greater for the same explosion condition than with the small relief plates. Explosion pressure in the tank was approximately 15 p.s.i. with this door.

Reports of crankcase explosions which have occurred since the application of the improved type doors indicate that the explosions have been contained, and dangers to personnel and equipment greatly reduced.

Additional Basic Factors

The investigation by the Texas Company into the subject of crankcase explosions differed somewhat in scope from that of the Navy in that the Texaco tests were aimed more at determining the basic causes of crankcase explosions and the basic factors affecting their severity.

One of the most interesting, and perhaps startling, conclusions reached in these tests concerned fuel oil dilution. No significant differences were found in the minimum ignition temperature of a wide variety of lubricating oils, *even when diluted with up to 20 per cent diesel fuel.*

The Texaco study also found that the crankcase atmosphere of a normally operating diesel engine is not composed of explosive gases or an appreciable amount of oil vapor, but of a potentially inflammable mixture of air charged with particles of oil sprayed and thrown from the engine's moving parts. With commonly used lube oils only negligible quantities of oil vapor are present until flame or an overheated part vaporizes sufficient quantities of oil particles to form, locally, an inflammable mixture of oil vapor and air.

Vaporization of the crankcase oil by an overheated part and its subsequent condensation can contribute substantially to the formation of an inflammable mixture when the engine is shut down. White smoke is thought to result from the vaporization of the oil mist by a hot surface, and the subsequent condensation to form a finely divided oil mist.

Experimental work by Haber and Wolff, two European scientists, showed that the lower limit of inflammability of the condensed mists of oils is essentially the same as for the oil in the form of a vapor, but that the flame speed was less in the mists and decreased with increasing particle size. It was also indicated that the lower limit of inflammability of lubricating oil mist compared closely with diesel fuel and other lower flash point hydrocarbons.

Tests conducted by the U.S. Bureau of Mines indicate that decreasing the oxygen concentration of a mixture of air and oil mist will narrow the inflammability limits until a minimum oxygen concentration (about 12 per cent) is reached below which flame will no longer propagate.

Certain changes in the crankcase atmosphere occur during primary and secondary explosions. Partial combustion of the oil vapor in the vicinity of a hot spot increases the fuel concentration and decreases the oxygen concentration because of the vaporization and partial combustion of the oil vapor in the vicinity of the hot spot. If sufficient energy is transferred from the hot part to the air-oil mixture before the oxygen concentration is reduced below the minimum for flame propagation, a primary explosion may occur. If this does not rupture the crankcase, and no additional air is supplied, the further reduction in oxygen concentration and the increase in oil vapor will render the mixture non-explosive.

If there is a sufficient time lag before enough energy is transferred from the hot part to the oil-air mixture, the oxygen concentration is reduced below the propagation minimum because of the partial combustion of the oil vapor in the vicinity of the hot spot. This is attested by the many instances where overheated parts have not caused crankcase explosions.

The extreme heterogenity of the mixture in the crankcase undoubtedly makes ignition a very complicated process. With an ignitor surface heated to 1,400-1,500 deg. F., in an air-oil mixture simulating that in a diesel crankcase, there is an appreciable delay before general ignition occurs. This delay is about the same for mixtures with large droplets as for those with a finely divided oil mist, but combustion is more complete with the finer mist. The minimum ignition temperature is from 1,400 to 1,500 deg. F., except for very lean mixtures where the minimum ignition temperature increases rapidly.

Over a wide range of oil-to-air ratios, the minimum ignition temperature is lowered by decreasing the air flow, and by increasing the mixture temperature and the ignitor size. As conditions for transferring heat from the point of ignition become less favorable, the mixture will ignite at a lower ignitor temperature. Therefore, improving the transfer of heat from the point of ignition will reduce the tendency for an explosion to occur.

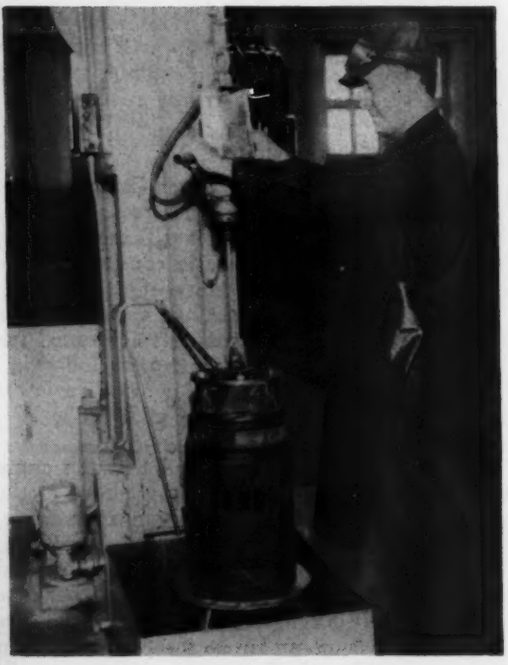
Simplifying Air Reservoir Removal

To remove air reservoirs from diesel locomotives for annual inspection, and to reapply them following inspection, the Great Western shops at Oelwein, Iowa, employs a portable lifter. The lifter consists of a long shaft, turned by a wheel at one end, around which are wrapped two long steel cables.

The shaft has two hooks which fasten to brackets on one side of the drum, and there are two hooks on the ends of the cables which fasten to the brackets on the other side. To remove a drum the wheel is first turned so as to raise the drum, which takes the weight off the bolts for removal. When the bolts have been removed, the wheel is turned in the opposite direction to lower the reservoir. The reverse procedure is employed for applying the drum.

Device for lowering air reservoirs preparatory to making annual inspection and for reapplying them upon completion of inspection. The view is looking upward from the pit

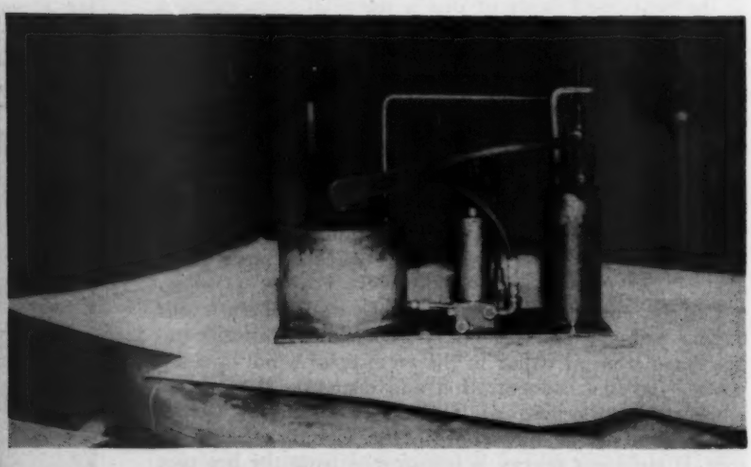
Car and Locomotive Ideas from the Chicago & Eastern Illinois



➤ A stand for holding locomotive hatch built of welded channel and angle-iron sections. It is mounted on maintenance-of-way car wheels and can be moved outdoors when the shop is crowded, if weather permits

▲ The cutting fluid for honing operations at the Danville, Ill., shops (diesel fuel oil rather than kerosene in this case) is distributed by an air-circulating pump removed from a lathe no longer in service

➤ A cart for hauling various rod assembly parts has end members with a pin welded in place between the sides to permit easy handling by crane



▲ Lash adjustor loader fills hydraulic lifters with a single stroke of the pump handle, avoiding the tedious job of pumping up the pressure by thumb

➤ Pump stand used in the diesel shop. The pump bolts to the main (white) section of the stand for assembling or disassembling. The two locks engage the gear teeth, one to keep the shaft from turning while removing the nut, the other while applying the nut

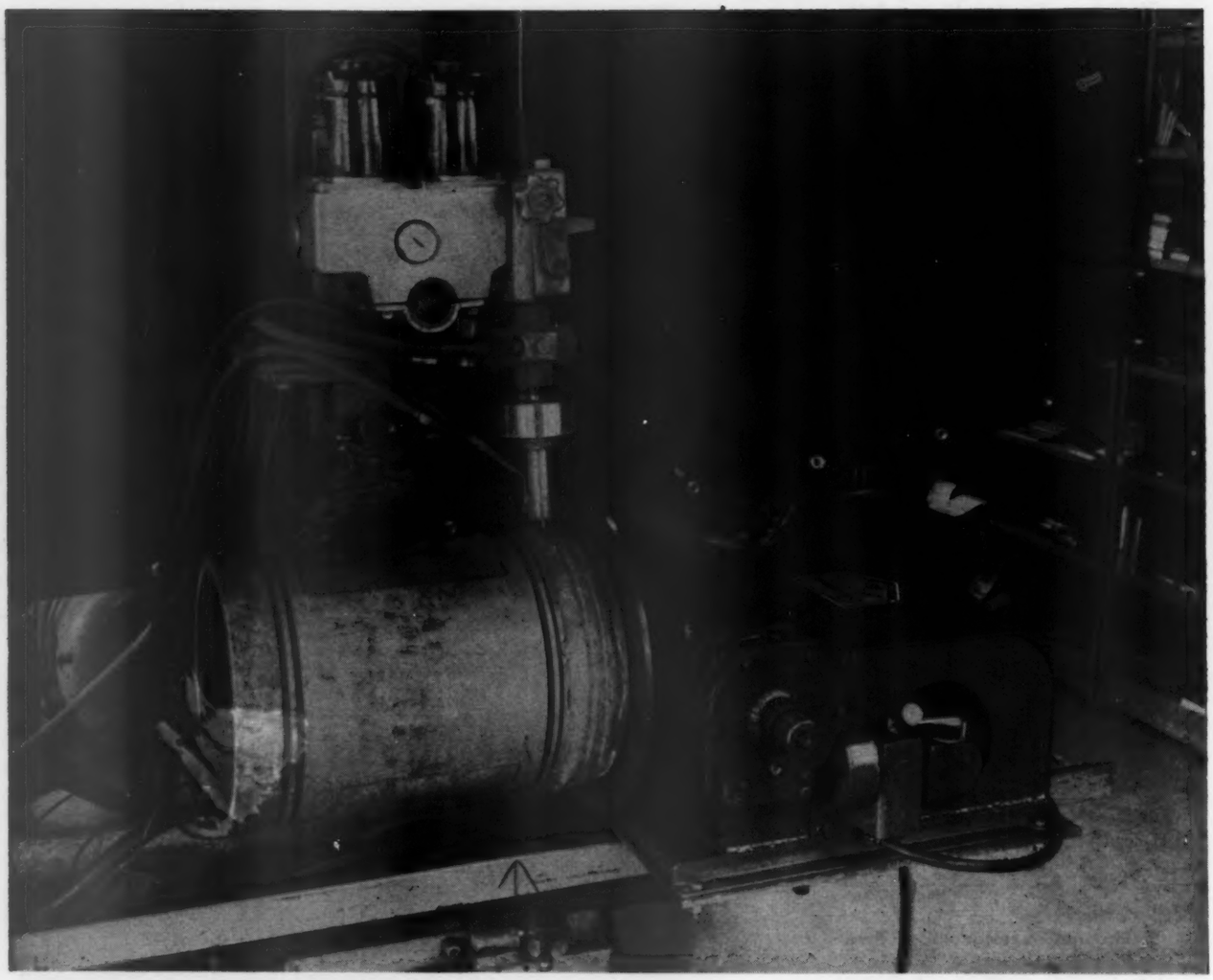
▼ For application of threshold plates floors are grooved with an air grinder fitted with a da-do head and mounted on a carriage. The grinder is guided by two small wheels on the operator's left which run in a channel iron strip nailed to the floor

▲ Any number of trucks can be moved at one time by a switcher when coupling rods are used. Each rod has two flared ends which fit over the body center pins of adjacent trucks. Connection with the switcher is made by the dummy coupler resting on the left side frame of the truck in the foreground. A ⅞-in. bolt on the coupler drops through a channel-shape member which fits around the knuckle

▼ Floor chairs mounted on four casters are used by the C. & E. I. for drilling, reaming, applying floor bolt nuts and other underneath work on freight cars

▲ Lumber prepared in the carpenter shop for the box-car building program at Danville, Ill., is strapped together in convenient size bundles for movement to the assembly shop

▲ Roof lifter used at Danville comprises an I-beam with clamps that drop over the running board and are secured by drop-end pins



Reclaiming Aluminum Diesel Locomotive Parts*

By La Motte Grover†
and R. L. Rex‡

THERE is an increased trend toward modifying the ordinary type of organization for railroad mechanical departments to include a centralized special diesel locomotive reclamation department under the supervision of a diesel reclamation foreman with carefully picked and specially trained personnel and with special equipment, including initial and final testing equipment; also with facilities for packaging for storage and facilities for shipment for reuse. Railroads that have adopted such an organization for diesel locomotive reclamation work have found that it has greatly increased their efficiency.

Fig. 1 (above)—Set-up for building up the worn ring-groove area of an aluminum piston by the automatic inert-gas-shielded metal-arc welding process employing a continuously fed filler-wire electrode

*Part 1 of an abstract of a paper presented before American Welding Society.
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Fig. 2—Aluminum piston on positioning rolls where ring-groove area is being built up by the manual tungsten-arc process of inert-gas-shielded welding

Fig. 3—Insulated cover placed over aluminum piston during welding of ring-groove areas by the tungsten-arc process. The opening in the end of the cover is for insertion of the oxyacetylene heating torch

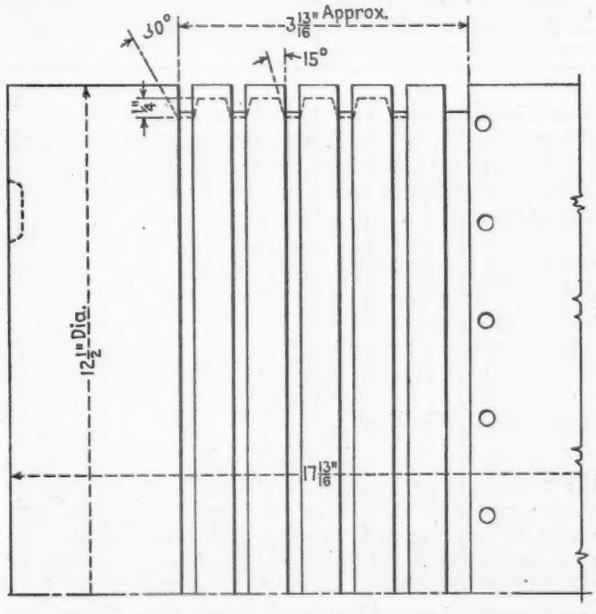


Fig. 4—Diagram showing extent of machining of worn ring-grooves of aluminum piston, 12½-in. diameter by 17 13/16 in., in preparation for reclamation by inert-gas-shielded-arc-welding

One of the best examples of continued development and refinement is in the reclaiming of aluminum pistons. The earlier practices of using oxyacetylene welding and conventional arc welding with aluminum stick electrodes have been replaced largely by inert-gas-shielded arc welding to save time and cost, and to provide higher quality weld metal than that deposited with aluminum stick electrodes. The tungsten-electrode inert-gas-shielded process, with the filler metal fed separately into the arc, Fig. 2, has come into general use where the volume of aluminum pistons to be reclaimed is not large enough to warrant the cost of the more elaborate equipment having a continuously fed filler-wire electrode, Fig. 1. However, the operating costs are considerably lower for the latter.

The most commonly occurring defects to be repaired are cracks or heat checks in the middle of the head of the piston (and around lugs, if the piston is of the type with lugs), for which manual welding is used; and worn ring grooves, for which the automatic or semiautomatic processes are more efficient, provided the number of pistons to be reclaimed warrants the cost of automatic equipment.

Whether or not a damaged piston warrants reclamation depends upon a number of factors—the extent of the surface involved, the character of the damage and whether its location is such that it can be repaired by continuous welding while the piston is being revolved on turning rolls or by some other device. If the piston is badly scored, it is difficult to prepare and the welding usually must be done largely with a manual holder while the piston is stationary rather than revolving. Damaged surface areas near mid-height require intermittent manual operation because the surface is interrupted by the wrist-pin bore.

On the other hand, even when the main compression seal-ring grooves near the top of the piston are worn quite badly, resulting in slap and blow-by or loss of compression, it is economical to repair such damage. Also a limited amount of localized cracking or spalling, and often a moderate amount of scoring can be repaired to good advantage by welding. Experience in any shop will indicate how badly a piston may be damaged and still be worth while reclaiming.

Both of the inert-gas-shielded welding processes that have been mentioned are available in either the manual or automatic type. Sometimes the manual gun of the

TABLE I—PROCEDURE FOR WELDING RING GROOVES WITH AUTOMATIC AIRCOMATIC HEAD

Preheat	300 to 350 deg. F.
Welding current	330 to 375 amp., d.c. (long arc)
Filler metal wire	⅛ in. diameter, 43S aluminum
Shielding gas	Helium
Revolving speed of piston	1½ to 3 r.p.m.
Number of layers deposited	Six (three in the machined grooves and three across the full width of the ring-groove area being repaired)

Remarks: No auxiliary cooling nor heating used during welding. Temperature of piston at finish of welding is 600 to 700 deg. F. After welding, piston is allowed to cool slowly in a preheated furnace or steam-heated cabinet.

TABLE II—PROCEDURE FOR WELDING RING GROOVES WITH AIRCOMATIC MANUAL GUN MOUNTED ON A FIXTURE

Preheat	300 to 350 deg. F.
Welding current	300 to 330 amp., d.c.
Filler metal wire	⅛ in. diameter, 43S aluminum
Shielding gas	Helium
Revolving speed of piston	1½ r.p.m.

Remarks: Same as for Table I. The time required for welding a piston with the manual gun is substantially greater than that required with the automatic head.

TABLE III—PROCEDURE FOR WELDING RING-GROOVES BY THE TUNGSTEN-ELECTRODE INERT-GAS-SHIELDED PROCESS

Preheat	400 deg. F.
Welding current	375 to 425 amp. (balanced a.c.)
Filler-metal rod	⅛-in. diameter (5% drawn silicon aluminum)
Electrode	⅛-in. tungsten
Shielding gas	Argon
Revolving speed of piston	As required for manual feeding of filler rod
Number of layers deposited	3 to fill machined grooves and 3 layers over entire width of ring-groove area being repaired

Remarks: Water-cooled holder with water-cooled nozzle. Piston heated during welding to keep heat uniform, but temperature of piston kept under 500 deg. F. After welding, piston is allowed to cool slowly in a preheated furnace or steam-heated cabinet.

filler-wire-electrode type (which is semiautomatic) is clamped with a nozzle in a vertical position over a revolving piston to build up worn ring grooves.

The application of one or the other of these inert-gas-shielded welding processes for reclaiming the large one-piece types of aluminum pistons has now become quite widespread. Although some experimental work has been done on a smaller type of piston with a shrunk-on sleeve that carries the upper ring-grooves, the reclamation of this type has not been developed to the stage of practicality, except to replace the ring carrier with a new one.

Savings by Welding

Cost figures from one source indicate that when all the ring grooves require rebuilding, for a one-piece aluminum piston of the type with lugs on the head, and when the machining to prepare it for welding is done as shown in Fig. 4, the total cost of reclamation, including preparatory machining, welding, finish machining, incidental operations and overhead, is less than 20 per cent of the cost of a new piston and less than 40 per cent of the previous reclamation cost. For the larger more costly type with dished head and no lugs, the total reclamation cost is little more than 15 per cent of the cost of a new piston. Very frequently only one or two ring grooves at the top need rebuilding, and the time and cost are considerably less. The time required for welding one of these pistons varies from 30 to 75 min., depending upon the extent of the wear or damage.

Some diesel manufacturers have proposed the use of replacement rings that are oversize in width a sufficient amount to permit the machining of worn ring grooves, rather than repairing the piston by welding and then machining it to fit standard-width rings. However, since this practice requires the stocking of two sizes of rings, it may cause confusion, and experience indicates that railroads, in general, prefer to reclaim the pistons and to stock only standard-width rings.

To facilitate continuous operation in building up worn ring grooves, the piston can be mounted on a turning-roll type of positioner with knurled rollers, driven by a small motor such as those that are used for driving small oxyacetylene cutting machines, equipped with a foot-switch control that will also reverse the direction of rotation.

Alternatively the piston may be mounted on a lathe-type fixture which causes it to revolve, with both ends of the piston supported; and in the case of automatic welding, the progress of the electrode holder is governed by the travel-carriage mechanism of the lathe, as it travels along the length of the ring-groove area.

The procedures that have been used for the inert-gas-shielded process with filler-wire electrode to weld aluminum pistons are given in Tables I and II, when preparatory machining is done as shown in Fig. 4.

Use of Manual Holders

It is sometimes convenient to use the manual gun employed for welding cracks in piston heads to supplement fully automatic equipment, when the volume of reclamation work occasionally runs more than can be handled expeditiously with one automatic head. When the gun is manually guided, as in the welding of cracks in piston heads, a lower welding current is used, about 260 amp.

The welding is started at either end of the ring groove area that is to be built up, and it progresses toward the opposite end as the piston revolves. At the end of depositing each layer, the welding tip or head is raised a moment and the new layer is started, progressing in the opposite direction, and so on until the welding of the area is completed.

For the Tungsten-electrode process, the water-cooled manual holder with water-cooled tip is used, held by the operator rather than being mounted on a fixture, and the filler metal is fed into the arc by hand, rather than employing a filler-wire feeder. When the volume of work is sufficient to justify the extra cost of providing fully automatic equipment, the use of the metal-arc process with filler-wire electrode is preferable because of its lower operating costs for this kind of an application.

When the Tungsten-electrode process is used, the rate of heat input is much less, and therefore the piston is enclosed in an insulated housing (Fig. 3). Also an oxyacetylene torch is mounted at the skirt-end of the piston and is kept playing on the inside of the skirt as the piston revolves, to supplement the heat of the arc welding on the ring-groove areas, and to keep the heat distributed uniformly.

The procedure used for the Tungsten-electrode process in this application is given in Table III.

As a typical example, one shop has reported that it requires about 2½ hr. per piston for reclamation by the tungsten-arc process, when only the top ring-groove must be rebuilt and some eight thermal cracks repaired in the head of the piston; and 5 to 6 hr. when the entire ring-groove area is rebuilt.

Regardless of what process is used, the piston is soaked first in a carbon solvent for cleaning, and all cracks are carefully veed out down to sound metal.

Experience has shown that when proper procedures are used, pistons reclaimed by any of the inert-gas-shielded arc processes will stand up in service at least as well as new pistons.

Small pump for testing ➤ pressure switches at the North Western's Kinzie street shops in Chicago. Positive pressure is checked by the gage arrangement at the left; vacuum, at the right

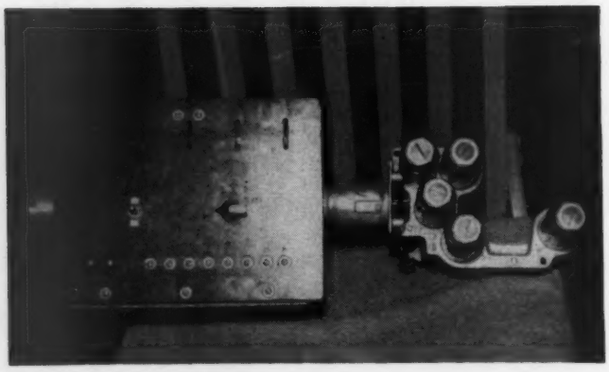
▼ Cart used in the engine repair room of the Kinzie street shops carries a complete set of tools for assembling or dismantling a Diesel engine. The cart is one of four individually assigned to a workman. It rides on rubber tires and saves running back and forth for small groups of tools as the work progresses

▼ Arrangement for checking connecting rods on the Great Western at Oelwein, Iowa. The dummy bearing in the background is in two sections, with the outer ring slightly eccentric. Lining-up marks on each ring give standard lengths. Feeler gages show deviation from the standard length

▼ Rack in use on the North Western for storing front end housings, back end housings, flywheel rings, flywheel plates and covers for various housings. It is built from scrap 2-in. flues and ¼ in. by 2 in. strap iron with a flooring of 3/16-in. plate. The floor is 14 in. above the shop floor to permit movement by lift truck

▼ Cutting plate used by the Great Western both to cut and shape piston clearance leads simultaneously. The lead wire is run through holes on the two side guide bars and the wire is shaped and cut by pulling the center sliding plate towards the operator

Test Box for E.M.D. Governors



The solenoid coils and the leads to each solenoid on Electro-Motive diesels are tested at the Parsons, Kan., shops of the Katy by an easily carried test box equipped with a light. Coils are tested individually by plugging the assembly into one end of the box (the right in the illustration).

The box is wired to bring out to its terminals the leads of each solenoid and of the low lube oil switch for measuring resistance and for circuit testing with an ohmmeter. With a 74-volt supply across the terminals of the box, the selector switch is moved to test each individual coil.

The locomotive governor cable is plugged into the other end of the box. When the throttle is operated, lights indicate whether a circuit exists to each solenoid to tell if they are properly actuated by movement of the throttle.

Assembling Liner And Water Jacket

The Springfield, Mo., shops of the Frisco have an excellent arrangement for assembling Alco liners to the water jackets which prevents pinching or nicking the water seals. The jacket fits in an opening in the top of the bench and is secured by cap screws; the liner is pressed in by a lever arrangement. The piston rack is adjacent to the work bench, and the jackets and liners are handled by a crane which extends between these two points.

Fig. 1 shows the operation of the lever to press the liner in place and the use of the tool to avoid damaging the liner seal. Fig. 2 illustrates how final alignment is made between the liner and the jacket, and shows the construction of the tool for saving the seal.

The lever arrangement is used in conjunction with a wooden block to press the liners in place. As an added help in providing a nearly direct downward vertical force, there are three adjusting holes at the fulcrum to keep the lever about horizontal at all positions of the entering liner. The lever pins are secured in each hole with a cotter key. When not in use, the lever is held in an upright position out of the workman's way by a safety catch on the base.

Final small adjustments in the alignment of the liner to the jacket are made by a pinch bar with one end against the base of the lever. The liner-jacket unit is then assembled to the piston and rod assembly by placing it over the latter with the crane.

The small tool shown near the bottom of Fig. 2 has a half-ring on the end. This is inserted in the water inlet hole as shown in Fig. 1 to guide the bottom liner seal past this hole in the water jacket as the liner is being forced in, thereby preventing damage to the seal.

Fig. 1—Applying an Alco liner to the water jacket. The tool shown inserted in the water inlet hole prevents damage to the liner seal by guiding it past this hole. After fitting the liner to the jacket, the assembly is placed over the assembled piston and rod on the rack at the left

Fig. 2—Final alignment of the liner to the jacket is made by a pinch bar. The tool for preventing liner seal damage is hanging at the bottom

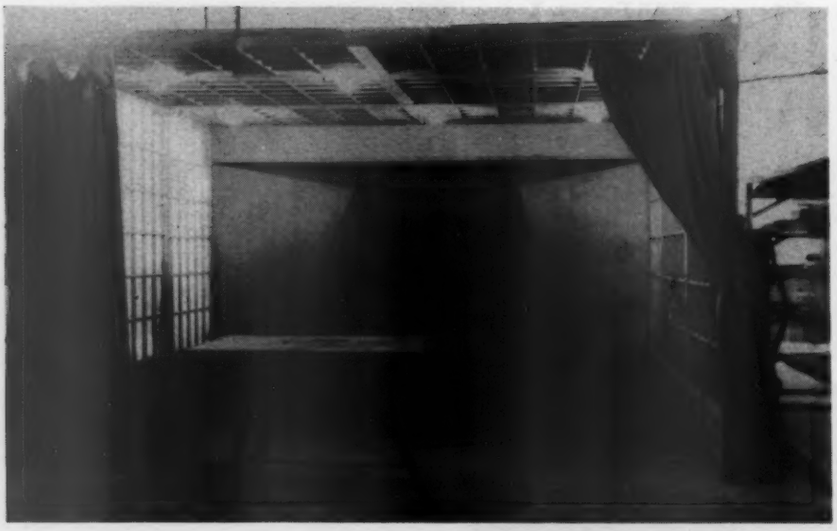
Short Cuts in Car Work from the Union Pacific

▲ A portable pressure tank for spraying cleaning solution which has resulted in a saving of about 50 per cent both in cleaning solution and time over hand methods. The tank is operated by air pressure from the yard air line reduced to 35 p.s.i. Rinsing is done with a fountain-head spray

◀ Scaffold hangers running on a separate line give access to an entire car side for body rubbers and other suspended tools. The cord on one side is for the machine; the other, for the counterweight

▶ Air conditioning system evaporator hoist used by the Union Pacific at Omaha for applying the evaporator to the car.—The Table which holds the evaporator is lifted by a pulley arrangement worm gear driven from a crank handle—It is in three easily knocked down parts (the base, the table and the upright) for carrying in and out of the car

▼ Quick and accurate way to cut passenger-car rubber-floor covering to the correct width. The arrangement has a roller on each end and a crank on the right, or cutting, end. The crank draws the covering past the two knives on the table to trim the roll to the correct width. Trimming to length is done in the car

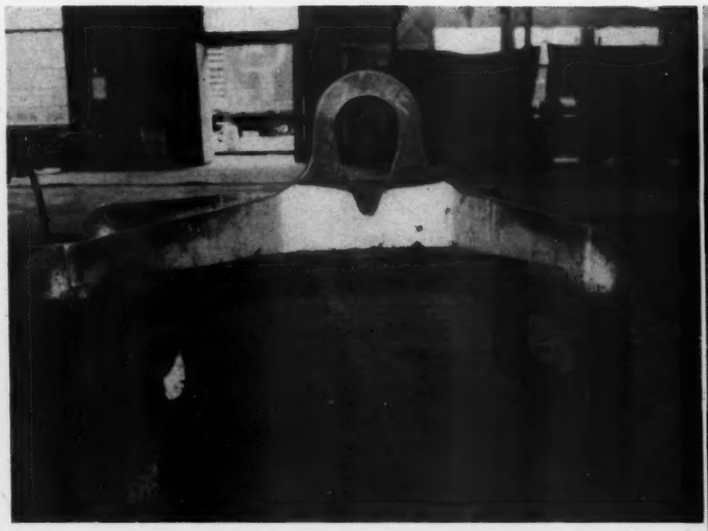


▼ This layout at Council Bluffs is for removing passenger-car generators and other heavy underneath parts. The car is spotted over the concreted area, and the short section of rail on one side removed by loosening the rail joint bolts. The part is then dropped on a dolly which is easily moved into and out of working position over the concrete without any rail obstruction

▲ A well lighted and adequately ventilated room for paint spraying small parts, on the Union Pacific at the Omaha shops

➤ Arrangement for lifting or removing universal air-brake-control valves on passenger cars in the yards. The carriage is on rollers for movement along the track, and the jack is on rollers for movement along the carriage. Lifting is done with the light scissors jack

◀ The Union Pacific has found that dry cells can be given up to six recharges with the above layout installed at Council Bluffs—The table holds 49 lantern batteries and 256 flashlight batteries—A 6-volt current is applied across each of the lantern batteries, and across the flashlight batteries in series of fours—The test for serviceability is made with a voltmeter



▲ A sturdy lifter for moving all types of four-wheel trucks around the Omaha freight-car shops

▲ Jig to clamp elliptic truck springs for removal —The jaws of the jig fit under the bottom of the truck side frame, and the jack rests on the truck bolster secured by two bolts which drop through holes in the end of the bolster—After the eliptic spring is compressed, the rectangular member is slipped over and secured with a key and pin to hold the spring compressed

▲ Roller-bearing holders made at Council Bluffs shops to keep boxes from tipping and allowing water to enter the hole in the back

➤ Jacks are recessed in the corners of the drop pit at Council Bluffs to save jacking up the entire end of a car—The 50-ton jacks serve to take the strain off the equalizer

Three Santa Fe Car Shop Devices

Underframe Turner

The Atchison, Topeka & Santa Fe has devised a simple underframe turner for use in its Topeka shops. The member on the left in the close-up view fits into the coupler opening. The key in front of this member goes in the draft-gear-key slot in the underframe.

The underframe turner in the operating position

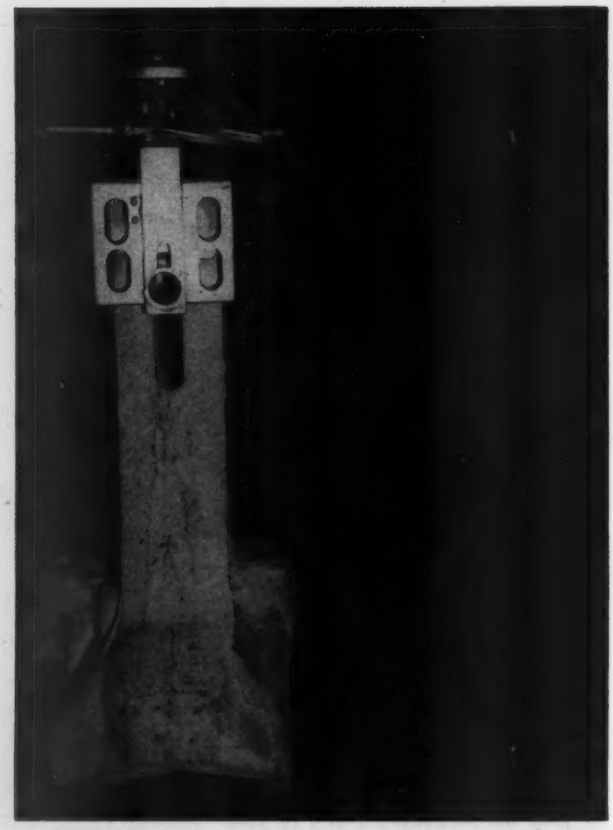
The three principal members of the turner

With one such arrangement in each end of the underframe as shown in the operating view, turning is accomplished in either of two ways. If the air brake parts are applied, the underframe is enough heavier on one side that it flops over by itself upon being lifted. In other cases this can easily be done by hand.

Reaming Built-Up Couplers

When the key slots in the butt ends of freight-car couplers have worn elongated from service, they are reconditioned by building up the pulling end of the slot by welding and then reaming it to standard size.

A holding stand for the reamer fits over the butt end of the coupler and is secured in place by two set screws.



The reamer is fed into the built-up pulling end of the coupler by a hand feed wheel

This holder has a vertically sliding section with a hole to guide the reamer, and this section is moved up and down by a hand fed wheel to bring the reamer against the built-up section of the slot.

The reamer is turned by a conventional shop air motor. The motor is supported by an L shape stand, made of 1¼-in. pipe, the horizontal leg of which fits in the

Arrangement for reaming the built-up pulling end of coupler slots, showing the method of supporting the air motor

knuckle pin hole. The vertical leg resists the torque of the motor through a U shape bar on top into which the handle of the motor fits.

Reworking Evans Auto-Loaders

At Argentine, Kan., a fast and economical method of reconditioning the chain assemblies of Evans auto loaders has been developed. A counterbalanced air motor is used for the operation in conjunction with a special chuck and fittings for the taps and dies.

The special chuck is attached to the air-motor shaft through a swivel joint and is in the shape of a solid drum except for a groove milled out of the bottom. The width and shape of this groove is such that it mates with the top of an eye from an eye bolt, and in this manner drives the tap or die. The other end of the eye is welded to the die holder or to the tap as the case may be.

The taps tap out the turnbuckle to $\frac{3}{4}$-in., $\frac{25}{32}$-in. and $\frac{13}{16}$-in. sizes to take care of progressive wear. The dies are the same sizes, and both are used in right- and left-hand thread styles. The die holder is machined for the dies to fit, and they are secured in place by two set screws.

Above right: Tapping out the turnbuckle on the chain assembly of an Evans auto loader

Right: The die holder is driven by the air motor through a special chuck with a groove machined to mate with the eye on top. The dies are secured in the holder by two set screws

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives*

Cylinder Liner and Water Jacket

250-Q.—Does the cylinder liner fit tight into the water jacket? A.—No. A sealed water space is provided between the liner and jacket.

251-Q.—What term would be used for this type of liner? A.—It is called a wet liner, as the space between the liner and block is used for a water jacket.

252-Q.—What provides the sealed water space between the liner and jacket? A.—They are assembled together with rubber gaskets.

253-Q.—How many gaskets are provided? A.—Two seal rings on the lower portion of the liner and one on the top flange of the jacket.

254-Q.—How does the assembly seat in the cylinder bore? A.—With a safety gasket at the bottom of the water jacket.

255-Q.—What is the purpose of the tell-tale hole in the water jacket? A.—To give indications of a leak past the seal rings.

256-Q.—How is accurate clearance volume maintained? A.—With a metal to metal fit between the cylinder head and liner and liner assembly to frame.

257-Q.—How is the liner cooled? A.—Cooling water enters the liner assembly through a jumper at the bottom of the jacket. It then circulates around the liner, cooling the walls and then passing to the cylinder head through rubber grommets.

258-Q.—What is the purpose of the flutes on the liner? A.—For strength. Also to separate the flow of water and increase its velocity.

Connecting Rod and Crankpin Bearings

259-Q.—What kind of connecting rods are used? A.—High strength, alloy steel drop forgings.

260-Q.—What type crank pin bearings are used? A.—Precision type.

261-Q.—Describe the connecting rod further? A.—There are oil grooves in the big end of the rod and it is rifle drilled for oil passage to the upper end. A bronze bushing is pressed into the eye of the small end of the rod. The cap is the conventional box type, aligned to the rod by a dowell and extended lips.

262-Q.—How many bolts are used, and are the caps interchangeable? A.—Four bolts are used to secure the cap to the rod. Caps of different rods are not interchangeable.

Cam Shafts and Camshaft Bearings

263-Q.—How many camshafts are on the diesel engine? A.—Two cam shafts, one for each bank of cylinders.

264-Q.—How many cams are on the camshafts? A.—There are three cams for each cylinder, as follows: (1). Air Inlet—(2). Fuel Injection—(3). Exhaust.

265-Q.—Is the camshaft all in one section? A.—No. Each camshaft is in three sections for the 12 cylinder engine and four sections for the sixteen cylinder engine, covering two cylinders each.

266-Q.—At which point are the sections bolted together? A.—At the third and fifth camshaft bearing for the 12 cylinder engine and at the third, fifth and seventh for the 16 cylinder engine.

267-Q.—How many bearings does each camshaft have? A.—Nine for the 16 cylinder engine and seven for the 12 cylinder engine. The lower half of each bearing pedestal is cast integral with the camshaft casing.

268-Q.—Are the cams a part of the camshaft? A.—Yes. The cams are forged integral with the shaft and are accurately machined, heat treated and hardened.

269-Q.—How is the assembly lubricated? A.—Lubricating oil is supplied under pressure to the individual camshaft bearings. The cams run in a bath of oil supplied by the camshaft bearings and rocker arms. The oil traveling down the push rod tubes lubricates the cam followers and crossheads.

270-Q.—How many camshaft casings are on the engine? A.—There are two cam shaft casings on the engine, one on each bank of cylinders.

271-Q.—Are the cam shaft casings interchangeable? A.—No.

272-Q.—How is the lower portion of the casing made? A.—The lower portion of the casing is so cast as to create a lubricating oil reservoir which will rise to a predetermined level, controlled by an overspill hole returning oil to engine base sump.

Crank Shaft and Main Bearings

273-Q.—How is the diesel engine crankshaft made? A.—It is made of special steel alloy. The main and crankpin journals are made especially large to obtain utmost rigidity and low bearing loads.

274-Q.—How many crank throws is the crankcase equipped with? A.—There are eight crank throws on the sixteen cylinder engine and six on the twelve cylinder engine, on each of which are mounted two connecting rods side by side.

275-Q.—What provision is made for lubrication? A.—Drilled lubricating holes are provided between the main and crank pin journals.

276-Q.—Describe the generator end of the crankshaft. A.—On the generator end of the crankshaft, the drive gear is of the split type bolted in place while the generator flange is integral with the shaft.

277-Q.—Describe the free end of the crankshaft. A.—At the free end there is a flange for mounting the vibration damper, drive gear for both oil and water pumps, and the extension shaft.

278-Q.—Describe the main bearings. A.—They are of the underslung type. The upper bearing saddle is a part of the engine frame. The lower saddle is the cap which is secured by two bolts.

279-Q.—How is accurate location of the cap taken care of? A.—The cap joint is tongue and groove to insure accurate location and maximum rigidity under working loads.

280-Q.—Are the bearing caps interchangeable? A.—No. Do not mix them up. On the right side of each cap on the outer lip is stamped the bearing cap number and engine serial.

281-Q.—How are the bearings located as to number? A.—The No. 1 bearing is at the free end of the crankshaft.

282-Q.—What serves to prevent rotation and longitudinal motion of the main bearing shells? A.—A shell lock in cap prevents rotation and longitudinal motion.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives.

283-Q.—What is done to insure bearing lubrication? A.—The shells are grooved to distribute lubricating oil on the bearing as well as to supply oil to the connecting rods for lubrication and piston cooling.

Main Frame and Base

284-Q.—What is the function of the Main Frame? A.—The main frame houses and supports important components of the engine.

285-Q.—Describe the main frame. A.—It is of all steel welded construction. The upper halves of the main bearing supports are welded to the frame, forming a rigid mounting, carrying the crankshaft.

286-Q.—How is the main base constructed and how is it related to the main frame? A.—It is of all welded steel construction. The base and frame are securely bolted together approximately in line with the crank shaft position.

287-Q.—What else is attached to the main base? A.—Welded to the base are two pads which support part of the Diesel engine weight and form the mounting of the base on the locomotive frame. A generator adaptor rigidly bolts to the base at one end and has two additional pads which fasten to the locomotive frame, giving four point mounting.

Schedule 24 RL

Air Brakes

Train Control Operation (*continued*)

1161-Q.—Suppose that a suppression valve is not used? A.—Passage *5* leads to stop reservoir pipe *5*, stop reservoir, through the 3/8 in. check valve, passage *8* in the brake valve and connecting passages to atmosphere.

1162-Q.—What are the connections if a suppression valve is used? A.—Passage *5* leads to pipe *5* and passage *6* on the suppression valve, through the valve and out passage *8*, pipe 8, and brake valve to atmosphere.

1163-Q.—What insures the movement of brake valve service application piston to its upper position? A.—Choke *K* in the piston prevents build up of air from chamber *A* below the piston into chamber *B*, hence the piston is moved upward due to the reduction in chamber *B*.

1164-Q.—What would be the result if the brake valve handle is moved to Lap position? A.—Passage *8* in the brake valve is closed to the exhaust.

1165-Q.—Does this prevent piston 112 from remaining in its upward position? A.—No. The air from chamber *B* on top of piston *112* is quickly vented past upper valve *82* in the timing valve into the stop reservoir pipe and the stop reservoir.

Cab Signal Operation

1166-Q.—How does the air flow to the timing valve? A.—From the reducing valve through the strainer in the pipe to the timing valve through two supply branch pipes.

1167-Q.—How does the air flow from branch 1? A.—Branch pipe No. 1 permits air to flow past lower magnet valve *243*, which is unseated when the timing valve magnet is energized, to ball check *27*, which is lifted, supplying air to the chamber below piston *90*.

1168-Q.—Where else does reducing valve air flow? A.—Through the combined change-over switch and cock direct to the chamber below piston *90*.

1169-Q.—What does this insure? A.—That piston *90* remains in its upper position at all times in cab signal service.

1170-Q.—What happens when a cab signal indication is received by the timing valve magnet? A.—The magnet is de-energized.

1171-Q.—What movement occurs when the magnet is de-energized? A.—The spring moves lower valve *243* and upper valve *240* upward. Lower valve *243* is seated and upper exhaust valve *240* is unseated.

1172-Q.—What is accomplished by the movement of these two valves? A.—When the lower valve is seated air supply from pipe *1* is cut off, and when the upper valve is unseated, reducing valve air from the combined change-over switch and cock flows through the chamber below piston *90*, through choke *X* at the ball seated check valve *27*, and past unseated exhaust valve *240* to the timing valve whistle and the fireman's call signal circuit controller.

1173-Q.—How long does the timing valve whistle blow, and the fireman's call signal operate? A.—Until the cab signal changes to a less restrictive indication, or unless acknowledgment is made.

1174-Q.—What would then happen? A.—In either case the timing valve magnet is energized.

1175-Q.—With the energization of the magnet what takes place? A.—The upper exhaust valve is seated, cutting off air supply to the timing valve whistle and the fireman's call signal circuit controller. The lower valve is unseated, permitting charging of the cab signal system.

Operation of A-1 Suppression Valve

1176-Q.—What can be done to prevent a train control application? A.—The brake should be applied manually.

1177-Q.—What does this accomplish? A.—A brake application of prescribed amount will suppress the train control brake application for a limited time, which may be sufficient to reduce the speed below the speed restriction in effect.

1178-Q.—In this case how may the brakes be released? A.—The brakes may be released in a normal manner.

1179-Q.—What is the result if the train is approaching a restricted signal under this temporary suppression condition? A.—If the signal clears, the brake may be released in the normal manner and train can proceed without being brought to a stop if the speed and length of train permit.

1180-Q.—What action is taken to obtain suppression when operating the automatic brake system? A.—Move the brake valve handle to service or first service position within less than six seconds at sounding of the warning whistle.

1181-Q.—What is the procedure, if service position of the brake valve is used? A.—Make a brake pipe reduction of moderate amount for temporary suppression in freight service, or a full service brake pipe reduction in passenger service for permanent suppression.

Steam

Locomotive Boilers

By George M. Davies

Tapping Firebox Sheets

Q.—When applying radial stays and crown stays is it necessary to tap both sheets simultaneously with special taps to insure maintaining the lead of the threads through both sheets?—F. E. D.

A.—The general practice is not to maintain the lead of the threads through both sheets when tapping for long radial stays and crown stays as the elastic yielding of the bolts and the sheets is sufficient to take up the difference

in lead. However, this practice is not universal, in that some railroads maintain the lead from end to end by the use of such equipment as double headed threading machines with the heads adjustable for maintaining lead when simultaneously threading both ends of the staybolts of different lengths, also long ground taps for threading the sheets for the lower radials, and taps mounted on threaded guide bars, with the threads set in lead, for tapping the sheets for the application of crown stays.

Welder's Qualifications

Q.—Is a welder qualified indefinitely?—M. V.

A.—The operator qualification tests vary on the different railroads, but as a general rule the operator qualifications tests once complied with remain in effect indefinitely unless the operator is not engaged in a given process of welding for a period of three months or more or there is some specific reason to question his ability.

Why Butt-Weld Shell Courses?

Q.—What is the purpose of butt welding the shell courses together at each end of the riveted longitudinal seams for a distance of approximately 12 inches?—V.B.F.

A.—The A.S.M.E. Code provides that the ends of inner buttstraps of riveted buttstrap longitudinal joints may be fusion welded to the edges of the heads or of the adjoining shell plate, or to circumferential buttstraps for tightness, provided the carbon content in the steel does not exceed 0.35 per cent. When the buttstrap of a longitudinal joint does not extend the full length of the shell plate, the abutting edges of the shell plate may be welded provided the distance from the end of the buttstrap to the edge of the flange of the head or adjacent shell plate is not greater than 2½ inches. On locomotive boilers the outside buttstrap is not extended to the adjacent shell course to provide for caulking the edge of the outside buttstrap leaving a short distance of the longitudinal joint of the shell plate exposed. Originally this section of the joint was sealed with a plug which is now discontinued in favor of seal welding.

Reinforcement at Syphon Openings

Q.—On locomotive fireboxes equipped with syphons, is it necessary to reinforce the firebox crown sheet to compensate for the opening in the crown sheet?—F. M. P.

A.—The A. S. M. E. Code for Locomotive Boilers provides that openings for Firebox Syphons shall be reinforced as follows:—

In locomotive fireboxes, with or without combustion chambers, which are equipped with staybolted syphons, the openings in the crown sheet shall be reinforced as outined below:

(1) If more than 40 per cent and not more than 50 per cent of the total length of the crown sheet is removed, not less than 10 per cent of the removed longitudinal ligament shall be restored.

(2) If more than 50 per cent and not more than 60 per cent of the total length of the crown sheet is removed, not less than 20 per cent of the removed longitudinal ligament shall be restored.

(3) If more than 60 per cent and not more than 70 per cent of the total length of the crown sheet is removed, not less than 30 per cent of the removed longitudinal ligament shall be restored.

(4) If more than 70 per cent of the total length of the crown sheet is removed, lot less than 40 per cent of the removed ligament shall be restored.

Maximum Diameter of Staybolts

Q.—What maximum diameter of staybolts should be used in staying the fireboxes or waterlegs of locomotive boilers? There appears to be a difference of opinion.—M.G.

A.—The maximum size of staybolts to be used in staying locomotive fireboxes is limited by the Interstate Commerce Commission to 7,500 lb. per sq. in. of net cross-sectional area. Thus the spacing of staybolts is definitely limited for any given condition of plate thickness and boiler pressure and the required size of staybolt to support this area is readily computed.

The proceedings of the Master Boiler Makers Association recommends that ⅞ in. diameter staybolts be applied as a minimum and that 1-in. diameter be the maximum size and that bodies of rigid staybolts beyond 1 in. be turned down to $^{25}/_{32}$ in. between the sheets.

Using maximum diameter staybolts to support a given area, with the idea of keeping down the number of staybolts used is not desirable; smaller diameter staybolts are more flexible and give greater life to fireboxes than large diameter bolts.

An analysis of staybolt action would indicate that they do not break from direct or tensile load, the liberal factors of safety used would indicate that, and therefore other stress must be the cause of staybolt breakages.

One cause of staybolt breakage is the movement of the firebox sheets in relation to the outside or wrapper sheets. There is no doubt that the movement is considerable, due to the different conditions affecting the sheets. The outer sheet is exposed to the atmosphere and to the water temperature, the inner sheet to the water and fire temperatures, and these are modified in turn by mud and scale to the serious disadvantage of the firebox sheet, hindering its conductivity of heat to the water and causing a higher degree of expansion and subsequent contraction.

These movements of the sheets give the staybolts an angular or lateral pull and are most severe when there are the greatest temperature differences in the firebox.

These extreme differences occur in hasty firing up, cooling down, cold water washing or filling, and from cold drafts after the fire is knocked out. When the boiler is in normal operation, it is doubtful if the angular stresses are excessive and it is probable that the initial rupture, the first start of the breakage, occurs at some firing up time or other period of extreme temperature variation.

Staybolts break under the pull due to pressure, but only after the cross-section has been reduced by checking, a partial fracture induced by over-stressing the outer fiber of the staybolt at times of extreme movements.

The larger the bolt beyond actual requirements the more probability of its early failure, for the obvious reason that the stiffness and rigidity increases with the size, and large bolts are unable to respond to the firebox movements very many times before the fracture starts which ends with a broken bolt.

Almost invariably solid bolts break close to the outer sheets and due to this, the practice of drilling a telltale hole in the outer end gives warning of a broken or fractured bolt. The reason for the location of breakage is because the outer sheet is always heavier than the inner, is not as subject to movement and acts as a foundation for the staybolt, the other end of which is pulled laterally by the firebox movement.

Flexibility consistent with strength is a desirable and necessary feature in determining staybolt diameters; increase of size and strength decrease the element of flexibility upon which the life of the staybolt depends.

The Watchdog of the Diesel-Electric Locomotive

Proper protection against damage from grounds and flashovers is a necessity in locomotive operation. Application principles and functions of the ground relay are here discussed

By G. R. McDonald*

THE watchdog of a diesel-electric locomotive is the ground relay. It is always on the job watching for failure of the electrical equipment. A surprising number of features come under its jurisdiction. The relay itself is a simple device, with its coil connected between ground and some point on the power system. The things it does, cover a wide range of subjects which should be of interest to anyone using and applying this type of control. The following discussion will serve to illustrate some of the application problems and other features of this type of relay.

This relay detects grounds and/or flashovers, relieves the situation by removing generator field excitation and making appropriate changes in the control circuit. Along with this, a warning indication is given to the engineer that something has gone wrong with the equipment.

This discussion applies to an Alco-G.E. road locomotive. The ground relay considered has a pickup of 38 volts with a coil current of .056 amp. The coil resistance is 680 ohms.

Armature Grounds

Assume a low-resistance ground on a main generator armature as indicated in Fig. 1 (a). The generator is carrying load and the remainder of the power circuits are well insulated. The point of ground relay connection to the power circuit will be slightly positive with respect to the generator negative brush due to the drop through the commutating field. When the ground is in the immediate vicinity of the negative brush, the current through the relay will be in one direction. As it moves away from this point, the current in the relay will reverse. The maximum voltage will be applied to the relay when the ground is in the vicinity of a positive brush. Fig. 1 (b) illustrates this wave shape. Neglecting the slight amount of reversal when the ground is near the negative brush, it will be seen that the relay has an undulating d.c. voltage applied to it.

Two things affect the pickup of the relay under these conditions; the speed of the generator and the load on the generator.

Fig. 1 (c) shows the effect of speed or frequency on the pickup of the relay with no load on the generator. The plot covers the range from idle speed of the engine up to full rated speed.

Fig. 1 (d) shows the second variable; the amount of load on the generator. The drop through the generator commutating field causes a reduction in the effective voltage applied to the relay coil. The higher the generator load, the higher the armature voltage required to produce relay operation. The curve shows the range from zero up to a maximum load corresponding to series operation at approximately 30 per cent adhesion.

With a low-resistance armature ground, neither of the above variables is enough to prevent operation of the 38-volt relay at comparatively low generator voltage. If the ground has appreciable resistance, the relay pickup will be raised. With a coil which operates on .056 amp., the increase in generator voltage will be small as compared to a relay requiring a higher pickup current. Low pickup current is, therefore, of advantage in giving prompt indication of trouble and limiting the amount of damage to the armature insulation.

The effects of motor armature grounds on the ground relay are similar to those described for the generator. In each case, undulating voltage is produced, and to this must be added the voltage of the motor armature position in the circuit. For instance, if two motors were operating in series and a ground occurred on the motor armature connected to the positive side of the generator, the undulating voltage applied to the relay would then vary from approximately half, up to full generator voltage. This is a more favorable condition to produce relay operation than that described for the generator. If the ground took place on the negative motor armature, the undulating voltage would vary from about zero up to half the generator voltage. For motors connected in parallel the undulating voltage applied to the relay will vary in much the same manner as that described for the generator.

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Power Circuit Grounds

Power circuit grounds may be divided into two types: (a) accidental grounds involving one or more points of the power system, and (b) general leakage grounds such as might be caused by moisture condensation or other extreme moisture coiditions.

(a) Accidental power circuit grounds may take place on cables, motors, generators or other apparatus in the circuits. Under all of these conditions, the amount of d.c. voltage applied to the relay will depend upon the generator voltage and position of the ground in the power circuit. Whenever the point of grounding is positive, by 38 volts or more, with respect to the point where the ground relay connects to the power circuits, as illustrated in Fig 2 (a), the operation of the ground relay requires no further comment.

A ground on the negative leads *a* in Fig. 2 (a) has a tendency to short circuit the relay coil and there will not be sufficient voltage difference to operate the relay. If a second ground occurs on the positive side *d*, current will be supplied to the ground on *a* and to the ground relay in parallel. Depending on the magnitude of the ground current and the resistance of the ground on *a*, the relay may or may not give indication.

If the ground occurs on lines *b* or *c*, the relay has a better chance of operating. The steady-state drop through a motor series field will not be enough to accomplish this, but during transient conditions, the "kick" in the motor field will operate the relay.

This siuation might be improved by using a lower resistance coil for the relay or by changing the relay connections. The lower resistance coil has objections from other standpoints. Two changes in connections appear to be possible.

The most apparent scheme would be to use a potentiometer connecting the relay coil to the system part way between generator positive and negative. This could be done to insure relay operation on positive and negative grounds. It could also be so located as to protect the leads operating at half generator potential during series operation.

Another way of improving this situation would be to change the relay connection from *a* to *e* in Fig. 2 (a). With a ground on *a*, the relay would be subjected to transient voltages developed in the generator commutating field. With grounds on *b* or *c*, the relay would be subjected to the sum of the transient voltages of the generator commutating field and the motor field involved.

(b) The resistance between the positive and negative circuits of a locomotive and ground may be materially reduced by moisture condensation or heavy rain conditions. There are more connections made on the negative than on the positive side of locomotive power system. If leakage due to moisture is generally distributed throughout the locomotive, then the resistance from the positive circuits to ground will be higher than from the negative circuits to ground. This is illustrated by Fig. 2 (b), for the parallel connection, in which all of the leakage resistors indicated are supposed to be of the same

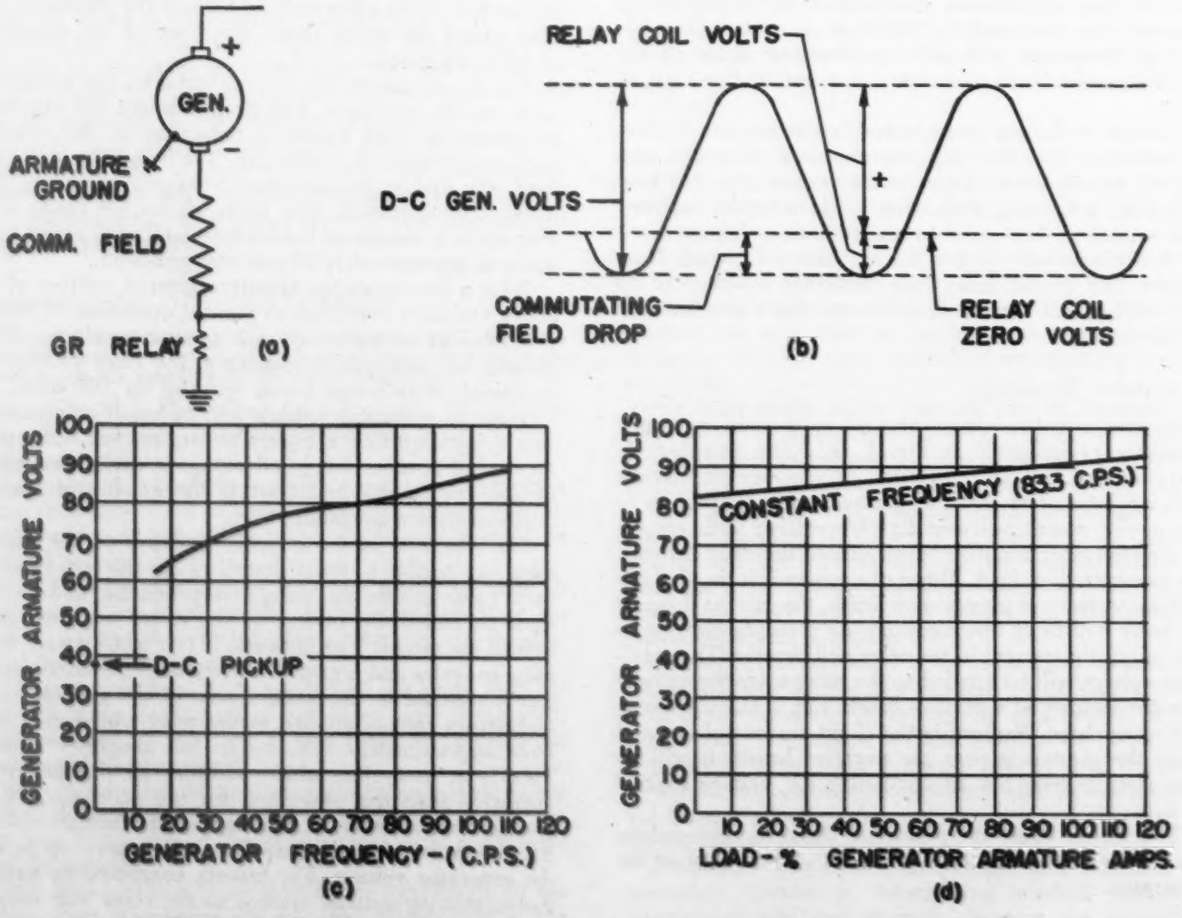


Fig. 1—Pickup of ground relay with generator armature and shaft securely grounded

values. This figure can be converted into the circuit of Fig. 2 (c). Using this circuit and assigning various ratios between positive and negative, the family of curves indicated by Fig. 2 (d) may be constructed. For instance, curve *C* indicates the conditions for operating the ground relay if the leakage resistance from the positive side of the system to ground is twice the leakage resistance of the negative side to ground. This set of curves has been plotted on log-log scale to separate the various curves for the sake of legibility. With the conditions of curve *C*, if the leakage current is high (resistance value low) ground relay operation takes place when the generator reaches 114.4 volts. If the leakage currents were initially low (high resistance values), then considerably higher generator voltage could be used. With motors connected in series, the permissible operating voltage of the generator appears to be slightly lower than illustrated by Fig. 2 (d), but the general shape of the curves is the same.

The process of drying up moisture leakage grounds is quite interesting. Fig. 2 (c) shows that the generator leakage current flows through the positive leakage resistance; then, in parallel, through the negative leakage resistance and ground relay coil. If the leakage resistance of the positive is higher than the negative, the watts loss between positive and ground is much higher than between negative and ground. The rate of drying will be faster on the positive and the ratio between the two resistances will increase as the drying proceeds. If the resistance of the moisture film is lowered by dirt, the rate of drying will be increased. If moisture conditions are suspected to be present, the locomotive throttle should be notched up slowly to permit drying the surfaces without reaching voltages high enough to cause tracking and permanent damage to the surface of the insulation. An excellent article on this subject is A.I.E.E. Technical Paper 51-123, "Factors Affecting Minimum Surface Leakage Distance in D.C. Power Systems," by Hart, Rosenberry and McClinton.

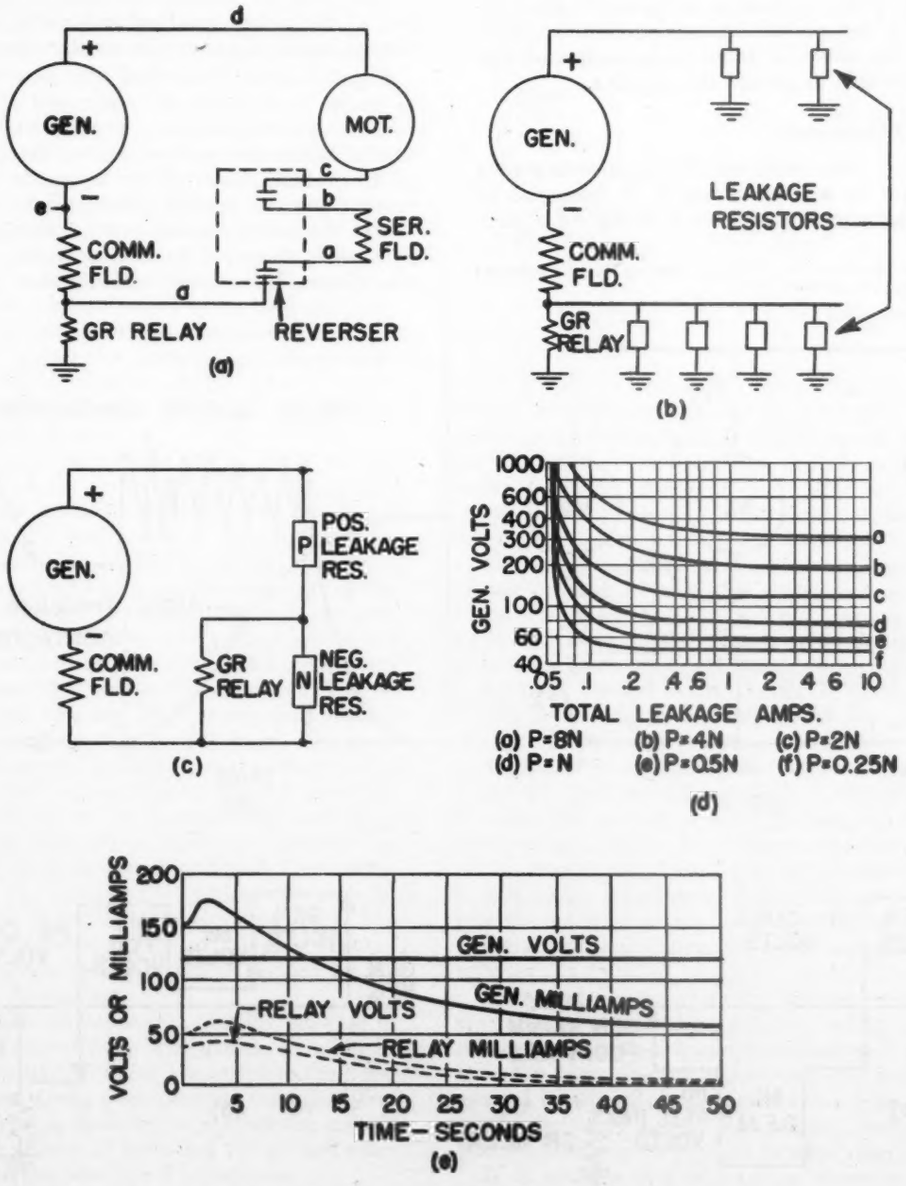


Fig. 2—Relay operation with power circuit grounds

Fig. 2 (e) is plotted from an oscillogram taken to illustrate the drying procedure, using the circuit of Fig. 2 (c). Leaage films were obtained by using water over an insulating paint. The positive film was arranged to have the cross section and the same length as the negative film. Hence, the positive may be assumed as starting with twice the resistance of the negative. The generator voltage was adjusted to give approximately relay pickup voltage at the start of the run and was held constant until the positive film dried.

Electric Osmosis*

Whenever cable is used in the presence of moisture and the conductor of the cable is negative with respect to grounded moisture on the outside of the insulation, electric osmosis tends to cause moisture to fill the pores in the cable insulation and cause a failure. Such cable is supposed to be more prone to failure than it would be if the conductor were positive with respect to ground. Actual experience seems to indicate that there is not too much difference in the operation of power systems between grounding the positive and grounding the negative. However, this could be taken as an indication that it would be preferable to ground the negative.

Commutator Flashovers

Flashovers may take place on the commutator of a traction generator or a traction motor. A discussion of the generator flashover should serve to bring out a number of the points involved and make it unnecessary to discuss motor flashover in similar detail.

* Electrical Engineers' Handbook, Third Edition, Volume IV, by Pender and DelMar, Section 6, page 25, paragraph 15.

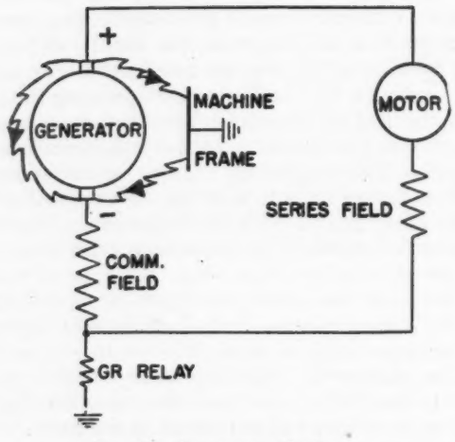


Fig. 3—Generator flashover

Fig. 3 indicates that flashover arcs may be regarded as going from brush to brush, and also from positive brush to ground and from ground back to the negative brush. Where the current leaves the positive brush to go to ground, there will be an anode drop. Where the current goes to ground, there will be a cathode drop. Where the current leaves ground and goes to the negative brush, there will be corresponding anode and cathode drops. This would indicate that ground potential

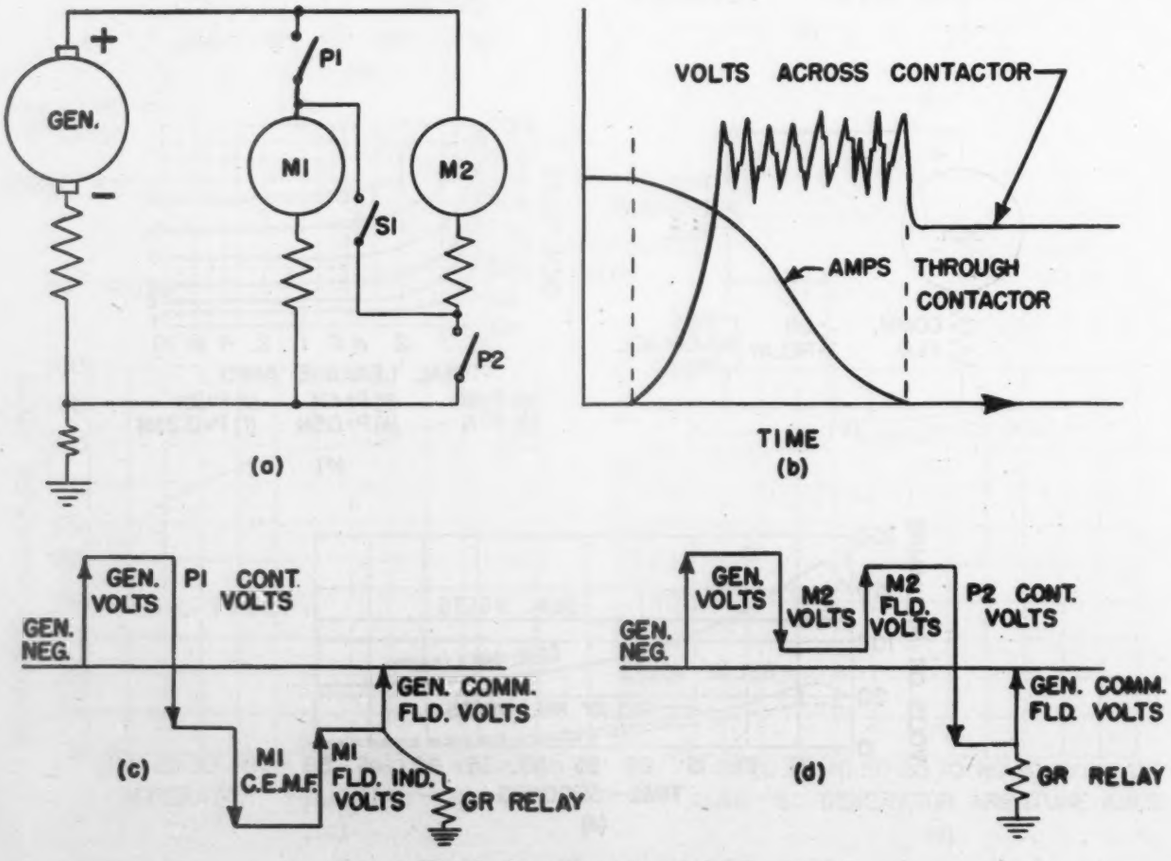


Fig. 4—Power contactor diagrams

should be approximately half way between the potential of the positive and negative brushes. During a flashover, the voltage across the brushes of the generator will be reduced somewhat and will be quite variable. Oscillographic records show that there is still a voltage of considerable magnitude; and as half of this voltage is available for the operation of the relay, no difficulty has been experienced in practice in having a negative-connected ground relay operate during a generator flashover.

Using a ground relay connected to one of the machine polarities provides positive operation. If the relay were connected to a potentiometer dividing the voltage across the generator there would be less voltage applied to the relay coil. Other potentiometer connections may be considered, but do not appear to afford good protection for flashovers of motors connected in series.

Power Contactor Flashovers

Fig. 4 (a) shows a simplified diagram of the power circuits of a locomotive, with the location of the power contactors. The space available for control apparatus in a locomotive is normally cut to a minimum, consequently, switching devices are closely spaced and little room is permitted for arcing. Normally little trouble is experienced due to flashovers of these power switching devices; however, under extraordinary conditions it is possible to have arcs from the contactors reach grounded metalwork.

The distribution of voltage and current in a contactor during current interruption is shown by Fig. 4 (b). As the contactor starts to open, voltage appears across its contacts; and as the contacts separate more fully and the arc is lengthened, this voltage builds up to comparatively high values. After the interruption is complete, generator voltage will appear across the contacts. Contactor operation also causes rapid changes of the power circuit currents. At such times inductive voltages ("kicks") are generated in the field circuits.

Assume that during opening the arc of contactor *P1* goes to ground. Fig. 4 (c) shows a probable voltage distribution around the complete circuit made up of the generator, contactor *P1* and motor *1*. The voltages are represented by vertical vectors. The horizontal lines have no significance but are used as a means of separating the various voltage components. Generator voltage is assumed as starting at the negative brush. The voltage across the contactor *P1* is assumed at the time when maximum voltage is being generated across this contactor. This is followed by the motor counter *EMF*, motor field voltage and the generator commutating field voltage. The position of the ground relay is indicated on this sketch also. Obviously, the ground voltage due to the arc must fall about midway along the vector representing the voltage across the contactor. The voltage difference between the arcing ground and the point of ground relay connection to the circuit may be estimated. It appears to be sufficient to give reliable operation of the ground relay. The voltage across the contactor will be of a highly fluctuating nature. This means that the voltage applied to the relay will also be fluctuating.

Fig. 4 (d) shows a corresponding plot for the case of a flashover on contactor *P2*. At first glance, it might be assumed that this contactor, being connected to the negative side of the line, would never develop enough difference in voltage during a flashover to operate the ground relay. Actually, the chance of operating the ground relay is just as good as in the case of a *P1* flashover.

A similar figure might be drawn for the series contactor *S1*.

A bridge connection for the ground relay, which would place its coil midway on generator voltage, would seem to give less reliable operation in the case of a *P1* flashover and more positive operation in the case of a flashover of *P2*.

Dynamic Braking

In Fig. 5, it will be noted that the generator supplies excitation to the motor field circuits which, in turn,

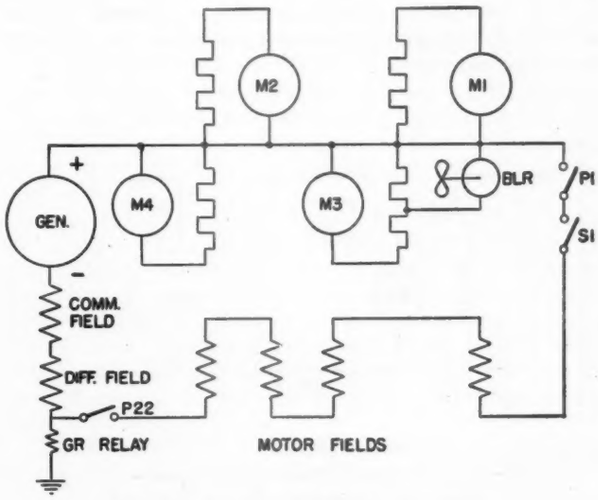


Fig. 5—Dynamic braking connections

excite the motor armatures. The armatures are arranged to feed into braking resistors. A small part of this waste power is used to operate a blower tapped across part of one of the resistors. Resistors and armatures are represented as being above or below the line connected to the generator positive to illustrate the direction taken by the voltages developed during braking.

The voltage applied to the motor fields for excitation during braking is quite low. A ground on one of these fields would not produce enough voltage difference to cause operation of the ground relay as long as steady-state conditions exist. However, any rapid change of motor-field current would result in inductive voltages which, depending on the location of the ground, have a chance of operating the ground relay.

A ground in a motor armature would cause an undulating d.c. voltage to be applied to the ground relay as discussed in connection with generator and motor armature grounds. The same comment applies to the armature of the blower motor used for cooling the grids.

A traction or blower motor flashover will produce ground potential which is fluctuating in character and will give sufficient voltage difference to operate the ground relay.

A ground on the dynamic braking resistor elements may or may not produce sufficient voltage to operate the relay. No operation would be expected if the ground is near the common connection from the generator. If the ground location departs considerably from this point towards the outer end of the resistor, sufficient potential will be produced to provide prompt relay action.

It is obvious that any motor armature ground or a fault in the braking resistors would require the opening of contactor "P22" to remove motor field excitation.

Ground relay protection is not usually furnished for control circuits and other auxiliary equipment, such as motor blowers. The battery is connected to the power circuits whenever the diesel engine is started. At this time, a ground on the control circuits or on the battery may affect the ground relay.

Batteries are a common source of grounds and there is some difference of opinion as to whether this type of ground should be permitted to interfere with locomotive operation. If the relay pickup voltage is low, it would tend to operate on most battery grounds. If the pickup of the relay were higher than the open-circuit voltage of the battery, it would never indicate a battery ground. A relay with 38-volt pickup represents a compromise between these two extremes.

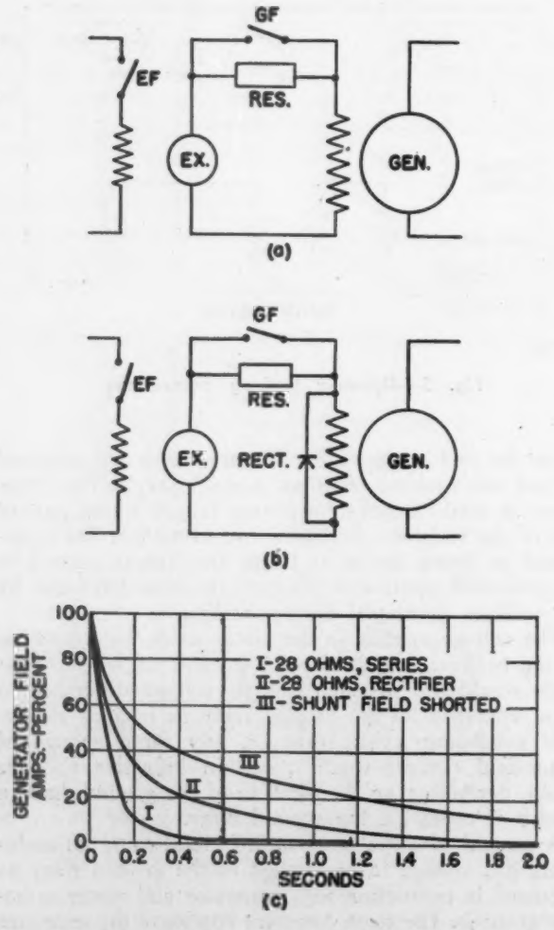


Fig. 6—Generator field excitation circuits applied to a machine having a two-ohm shunt field

The potential applied to a ground relay by a battery ground varies during the starting cycle. At the initial rush of current, most of the drop in the circuit will be in the series and commutating fields of the generator and the armature drop will be low. The relay will act as though it were connected in the circuit toward the positive side of the battery and will operate on grounds located toward the negative end of the battery. A relay fast enough to work at different points during these transient conditions will tend to check the battery from end to end.

Ground Relay Functions

Operation of the ground relay simultaneously opens the generator field contactor and exciter field relay, energizes a signal light, reduces the engine speed to idle, and opens the motor field excitation circuits if the equipment is in dynamic braking.

There are many operations of the ground relay which require high-speed response in order to minimize damage to the equipment. High-speed response is secured in several ways. The relay is a small, fast-operating mechanism and the devices which are used to perform auxiliary functions are as small and fast in operation as possible.

One of the main protective functions is the reduction of the generator field current to reduce generator voltage. The generator is provided with a low-voltage shunt field. It is, therefore, possible to arrange the generator field contactor to insert a large amount of resistance in the field circuit without producing voltages which would break down the field or circuit wiring. Common practice with Alco-G.E. road locomotives is to use a resistor having approximately 14 times the field resistance. The voltage across this resistor will momentarily be some ten times the voltage normally applied to the field. Another reason that this generator permits high-speed field reduction is the fact that there are no other closed-circuit windings on the field poles. Any other windings which form a complete circuit, regardless of the path of the circuit, would, by transformer action, slow up the reduction of generator voltage.

Fig. 6 (a) illustrates the circuit normally used with Alco-G.E. road locomotives. Both *EF* and *GF* are opened by operation of the ground relay. The decrease in generator field current, plotted against time, is shown by Fig. 6 (c), curve I. If *EF* only were opened, the field current would die down slowly as indicated by Curve III. To ease the duty on contacts in the field circuit and limit the inductive voltage of the field, a rectifier is sometimes used, Fig. 6 (b), to provide a discharge path. The rate of field current decrease thus obtained is shown by Curve II.

The generator voltage decrease would follow the shape of the field current curves, if the speed were held constant. During the time the field current is being reduced, the generator speed is also being reduced to idle, so the change in generator voltage will be faster than indicated by Fig. 6 (c). This is an important follow-up consideration.

General Considerations

An inspection of the foregoing considerations in connection with the application of a ground relay reveals very few points where the operating current or voltage of the relay could be considered at all critical. These are in connection with power-circuit grounds, power-circuit leakage grounds and dynamic-braking-equipment grounds.

In connection with power-circuit grounds, it was noted that a ground on one of the negative leads could short-circuit the coil of the ground relay. A very low-resistance coil for the ground relay would give better protection at this point. Such a coil would, on the other hand, produce other difficulties in that comparatively high current would be required for the operation of the relay. This would permit high current inrushes with greater damage from fault currents.

Fig. 2 (d) shows that, during general leakage conditions, only a part of the leakage current passes through the relay coil. Actually, the amount of leakage current is

relatively unimportant. The relay, in this case, serves as a means of preventing high-voltage operation of the traction generator. Thus it tends to prevent tracking during the drying period, which would cause permanent damage to the insulation.

Dynamic brake equipment uses a large amount of Transite to provide high-temperature insulation. Transite tends to absorb moisture and consequently, may have comparatively low resistance to ground. The braking resistor losses will dry the equipment rapidly without any danger of tracking or causing other damage. In this case, a higher current ground relay might be an advantage.

Ground-Relay Connections

Grounding the negative of a traction generator appears to be somewhat better than grounding the positive. This is normally accomplished by connecting the grounding relay to the outgoing lead from the generator. This practice appears to give good operating results. It would, however, be possible to ground the negative brush of the traction generator, thus getting on the other side of the commutating field. As discussed above, this would provide a small amount of additional protection against accidental grounds on the negative power cables.

Another means of connecting the relay would be to provide a potentiometer connection from the generator negative to positive, and connect the relay to this potentiometer. This has the disadvantage that operation on generator, motor and contactor flashovers would not be as reliable.

As a last resort in stopping a locomotive with inoperative brakes, plugging may be used. The consequences to the rotating equipment may be quite severe. Flashovers of the motors and generator are liable to take place. These would operate the ground relay and remove the generator excitation. This, however, does not affect the ability to maintain the plugging condition. The series motors act as generators and no source of potential from the generator is necessary, although the generator armature may carry the plugging current. The ground relay, is arranged so that it does not in any way interfere with obtaining plugging in emergencies.

Operation Without Ground Relays

With all ground-relay systems, it is customary to provide a cutout switch in series with the relay coil. This may be opened in case of a ground on the system or other emergency which tends to operate the relay and prevent movement of the locomotive. The ground relay should never be cut out except for an emergency condition where it is absolutely necessary to have the power of the locomotive in order to clear a track.

All of the protective features discussed above are sacrificed when this relay is cut out. Probably the most serious of these is protection against flashovers. There have been cases of operation with the ground relay cut out, where flashovers have taken place which did not clear themselves and continued long enough to cause serious damage to the equipment.

It is common practice to use the traction generator to check on engine horsepower, generator characteristics, etc. To do this, the generator is disconnected from the traction-motor circuits and connected to an artificial load. When making such tests, it is always advisable to be sure that the ground relay connections are not interfered with, and that this relay is fully operative to take care of any unexpected difficulty which might arise during the progress of the test.

The above discussion covers a number of features in connection with ground relay operation and application. It is believed that the discussion indicates the importance of this relay and some of its complexities. The discussion has been based on Alco-G.E. road locomotives, with no attempt to deviate far from this particular application. Undoubtedly, further study and experiment on the subject would result in improvements in this application. However, the system described has been in service for a good many years, and has provided a highly practical and successful degree of protection for locomotive equipment.

Authenticated News Photo

German double-deck electric train at the Frankfurt-am-Main terminal of the German Federal Railways. It is being tried out on the 212-mile Frankfurt-Cologne-Dortmund run and consists of three two-story cars, with a dining room in the upper deck of one of them and a seating capacity of 300 persons. The train weighs 110 metric tons (242,000 lb.)

View under the car showing the amplidyne inverter suspended from the center sill and the Enginator in operating position at the left

Axle and Engine Power for Buffet Car

D. & R. G. W. meets requirements of increased load by adding Enginator to car equipped with axle generator

THE Denver & Rio Grande Western recently obtained several buffet-lounge cars, and provided additional cooking facilities in buffet, thereby increasing the connected electrical load from 27 to 38 kw. The cars operate between Denver, Colo., and Grand Junction, Colo., on the "Royal Gorge" trains. In their new capacity, the cars are used to supply short order meals, bar service, and all lunch counter requirements.

Two hot plates and a griddle make up a major part of the added load

Originally the car was equipped with a General Electric, G.M.G. 150-A-3, 30-35 kw. axle-driven, motor-generator, and a 1,080 amp.-hr., 37-plate, 32-cell lead battery. A 6½ kva. amplidyne inverter supplies 110-volt, 3-phase, a.c. power. To meet the added load requirements, a 7½-kw. Waukesha Enginator was mounted under the car.

Regulated voltage (61 volts d.c.), provided by a safety lamp regulator, is used for incandescent lights, door engines and wheel slide control, the connected load being 1,207 watts.

The amplidyne inverter supplies 110-volt a.c. power to fluorescent lights, exhaust fans, juice extractor and the Rotoclone air cleaner. Input to the inverter is 5,000 watts.

In the original installation, unregulated d.c. power was used for the air-conditioning compressor, (Frigidaire 8-ton), condenser fan, condenser pump, blower motor, two-slice toaster, a four-burner Silex, three compressors which serve three refrigerators and one low-temperature box, and the air brake control. This load was 20,223 watts which, with 5,000 watts for the inverter, 1,207 regulated watts, and 515 watts, regulator loss, made a total connected load on the car of 26,945 watts, approximately 27 kw.

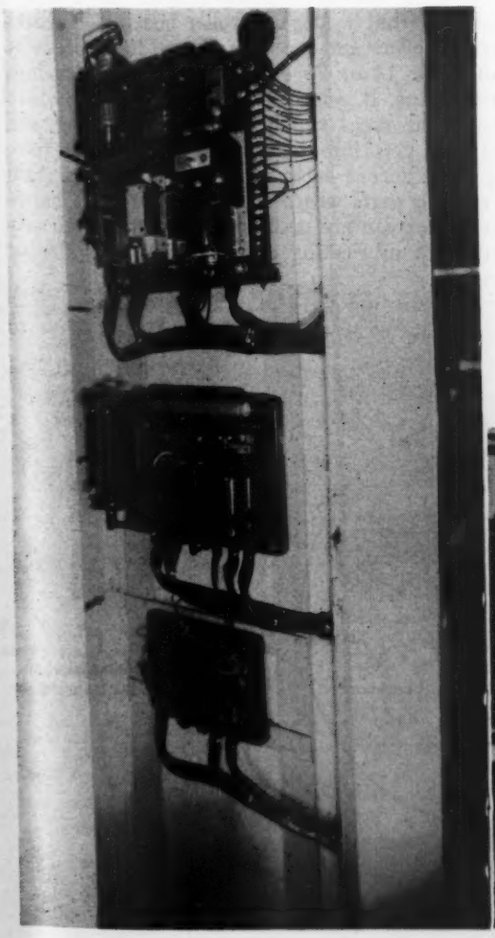
Left: Lounge section of the car. Right: The lunch counter provides short-order meals and lunch counter service

When the car was given the new service requirements, two hot plates, a griddle, two toasters and two drink mixers were added, making the total connected load 38 kw.

The Enginator is started manually from a pushbutton station in the car. When the axle generator voltage rises to about 45 volts, a relay disconnects the Enginator and shuts it down. This, of course, also happens when wayside standby power is used to drive the axle generator.

The service requires this particular car to lay over for three hours at Grand Junction, Colo. There is no standby service at this point, and the Enginator is used during the layover to insure starting the run with a full battery. It is also used during the run when the axle generator is not supplying power, and at the Denver terminal. Plans have been made for automatic starting as well as stopping of the Enginator, if operating conditions make it desirable.

Space is always at a premium on cars of this kind and to find a suitable place for the Enginator, where it could be rolled out for inspection and servicing, the Enginator was put in the place of the condenser and compressor control. The amplidyne inverter, under one side of the car was replaced by the condenser and compressor control, and the inverter was then suspended from the center sill. About eight inches end clearance is necessary to provide for application or removal of the inverter from the center sill. Space for the Enginator fuel tanks was obtained by moving two air reservoirs longitudinally a distance of about five inches.



Left: A broom closet provides space for the Enginator controls. Below: The Enginator rolled out on ways for servicing

DIESEL-ELECTRICS—How to Keep 'Em Rolling

3 Lubrication of Roller Bearings and Gears*

There are a few lubrication musts and a lot of don'ts in getting long trouble-free operation out of gears and bearings

THE AGE old sleeve type bearing is familiar to all of us. We have already seen that in this design the oil has the job of keeping the journal from touching the bearing.

Roller and Ball Bearings

HOW THEY WORK.—In the newer ball and roller type bearings, the lubricant still has to work with a sleeve bearing. You will see this if you think of a roller or ball bearing as being a series of wheels rolling between two tracks, (the inner and outer races). These wheels also roll in sleeve bearings, (the cage). If you could cut the inner and outer races of a roller bearing and lay them out flat like Fig. 1, that's exactly what you would have. Here the lubricant has an easier job than in the regular sleeve bearing because it does not have to support the load. It serves to keep the cage from touching the rollers while the cage is keeping the rollers from bunching up. It also lubricates the thrust flanges of the races.

There are many pitfalls in the lubrication and maintenance of roller and ball bearings. If you don't avoid them, they will surely cause some first rate trouble.

GREASE LUBRICATION.—The roller and ball bearings in many pieces of railway electrical apparatus are designed for grease lubrication. Actually this is the same as oil lubrication, since grease is made up of oil suspended in a form of soap. The soap holds the oil like a sponge, and releases it at the proper rate to lubricate the bearing. Grease is used because it is easy to keep in the bearing compartment.

WATCH THESE POINTS.—There are several things about grease and roller bearings that need careful watching.

1. If you think dirt is a trouble-maker in a sleeve bearing, listen to what it does to a roller bearing. It works in between the rollers and the cage. There it proceeds to ruin not one, but 14 or 20 or as many sleeve bearings as there are rollers. It gets in front of the rollers which pound it into the races causing a rough bearing and early failure. It gets into the grease and doesn't have the chance to settle out as in oil. Instead it stays right up in the moving parts where it can do the most harm. So whether or not you are godly, you have to be cleanly when it comes to lubricating and maintaining roller or ball bearings.

2. "And one for the pot" may work out fine when you are adding coffee to the percolator. It is no rule to

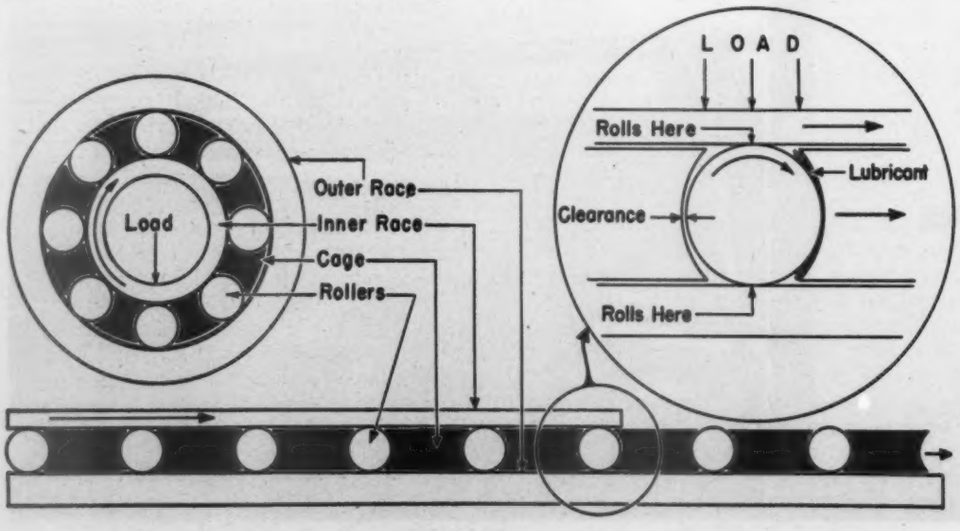


Fig. 1 Diagrammatic sketch of a roller bearing

* This is the 3rd of a series of articles on maintenance of diesel-electrical equipment. This article is written by J. W. Teker and J. H. Kathman, both of Motor Engineering Division, General Electric Company, Erie, Pa.

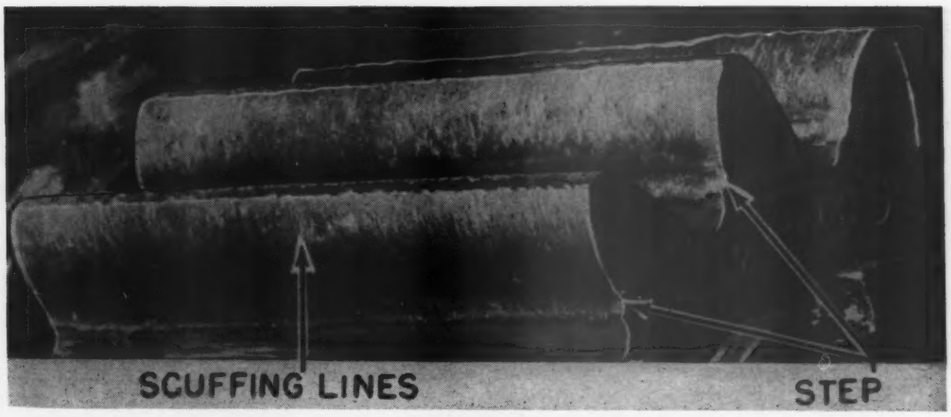


Fig. 2—Worn pinion showing step and scuffing lines on teeth

follow when adding grease to a roller bearing. That extra shot every lubrication period may easily cause a bearing failure. If the grease in a roller bearing is packed in so tightly that it cannot get out of the way, the rotating rollers and cage churn it. This heats up the grease, causing it to expand and make things worse. Finally, the grease gets so hot that it burns and can no longer lubricate the bearing, or the bearing gets so hot that it seizes. So, instead of a better cup of coffee, you end up with a costly repair bill.

3. Not enough grease in roller bearings is also a costly error. It can easily occur on bearings that require the addition of definite amounts of grease every week or so. This is specially true if the grease is added with a gun that squirts a shot every time a trigger is pressed. You probably figure that the gun squirts out a certain amount of grease every shot. This would be true if the gun were packed properly and in good operating condition. If, however, the cylinder is half full of grease and half full of air, the gun will squirt half shots. To stay out of trouble, it is a good idea to weigh the grease going into the gun. In this way, you can be sure it gets a full charge at each filling. Also, the weight of the shots should be checked frequently.

4. Another dangerous practice is mixing greases. If you start a bearing off with one kind of grease, continue with that grease until the bearing can be cleaned and refilled. If you mix a good grease with a poor one, the

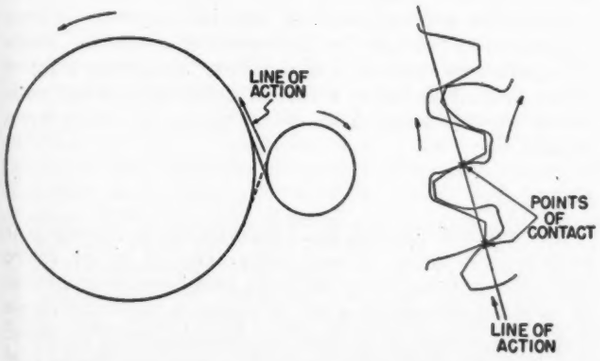


Fig. 3 — Analogy of gear and belt drives

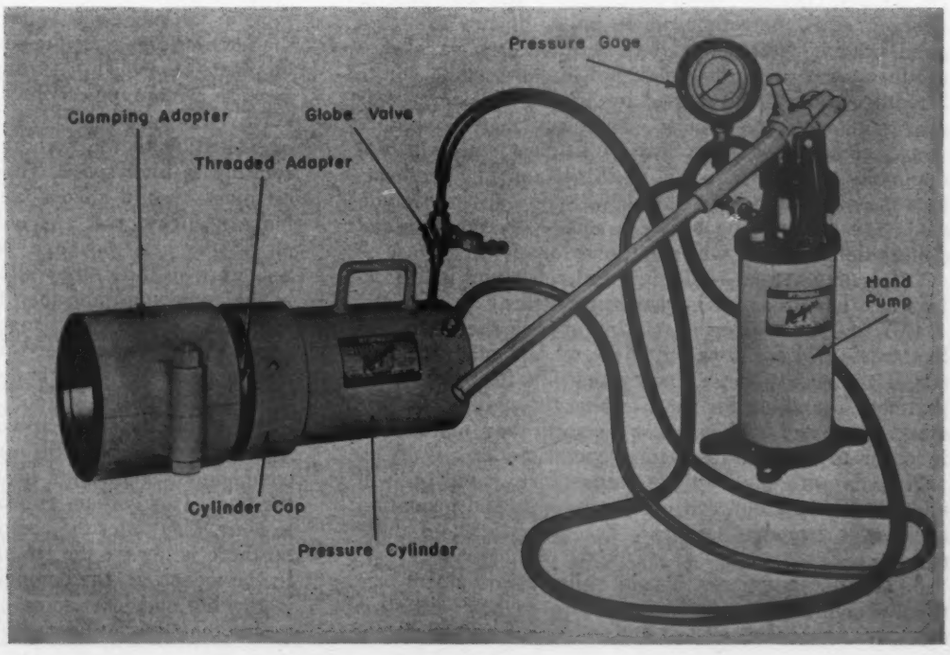


Fig. 4—Portable hydraulic pinion puller

Fig. 5—Damaged bearing race resulting from the use of a sledge on the armature shaft

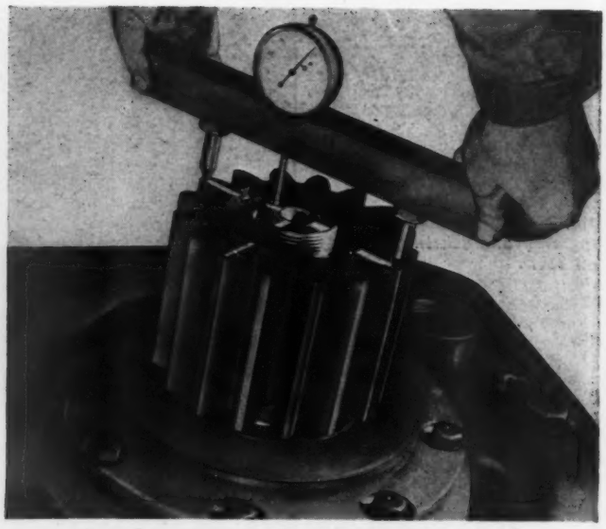


Fig. 6—Method of using a pinion advance gage

mixture will be no better than the poor grease. In addition, you may get into trouble because the two greases do not agree with each other chemically. Then, you will have a mixture that is worse than poor. It is especially important not to mix other greases with the high-stability greases used in sealed bearings.

5. If you could turn back the clock on any bearing failure, you would find that the bearing was hollering for help long before it failed. This gives the maintenance man a wonderful opportunity to catch bearings before they fail completely and damage the entire motor or generator. Listening rods are easily and cheaply made. With them you can readily hear all the moans and groans and clicking noises produced by bad bearings or rubbing seals. Sometimes it is quite difficult to tell a good bearing from a bad one. A good bearing always produces some cage and roller noises. Also, while you're listening, other noises caused by armature balance, gear operation, etc., creep in to complicate matters. Before you become an expert bearing listener you will undoubtedly tear down several machines and find the bearings in good shape. Don't let that discourage you. If you catch one bad bearing before it causes several thousand dollars damage, you will pay for a lot of teardowns.

OIL LUBRICATION.—Oil-lubricated roller and ball bearings also have their maintenance problems.

1. When the bearing is rotating at high speeds, it acts like an electric mixer as far as the oil is concerned. This causes the oil to form a foam which fills the entire compartment, searching for spots to seep through. Therefore, seals, plugs and gaskets must be accurately maintained in order to insure satisfactory operation.

2. Even with the best of maintenance, some oil will undoubtedly leak out, causing fire hazards and insulation troubles. Frequent cleaning is necessary to avoid these evils.

3. Bearing compartments in railway equipment are usually confined to small spaces and so have little oil capacity. As a result oil lost due to leakage and vaporization must be frequently replaced. This increases the possibility of getting dirt in the bearings. Here again, cleanliness is an important item.

The roller and ball bearings used in locomotive electric equipment are designed to give many thousands of hours of satisfactory operation. If a railroad is having a lot of roller bearing failures, a careful check should be made to see whether some of the above points are being overlooked.

Gears

The toughest job that Mr. Lubricant has is to keep gear teeth from chewing on each other. The oil in the sleeve and roller bearings must lubricate steel journals in bronze or babbit bearings. In a set of gears, it has to lubricate steel teeth sliding on each other. And do they ever slide!

A SPECIAL ASSIGNMENT.—Nearly everyone thinks that the teeth on gears are so shaped that they roll on each other. Actually that is true for only an instant. During most of the time that the teeth on the pinion are pushing the teeth on the gear, the surfaces of the teeth are sliding on each other. This sliding is under terrific pressure because of the power being transferred. The gear oil must stand up under this punishment. It must also manage to stick to the spinning teeth when the gears are rotating at high speed. To do this double job, the gear oil must contain a good quality oil and a substance to make it sticky. Just any old heavy oil won't work. Not all of the gear oils and compounds will work either. Some are so thick, they allow the gears to cut a groove in the compound, and then the gear teeth run dry. Some cannot stand the high temperatures in locomotive equipment, and soon become thick and hard. Some are too thin and break down under the heavy pressure. Even when you are using a good gear compound, you have to treat it right to keep it good. In many shops several steam pipes are run through the tank where the gear compound is kept, or a heating element is placed under the tank. This is done to heat the compound so it is easy to pour. The hotter the compound the easier it is to pour. So there is always the temptation to "turn on the heat." In the meantime, the compound back in the storage tank is cooking and loses some of its lighter substances. This means that it is heavier the next time it is used. If this

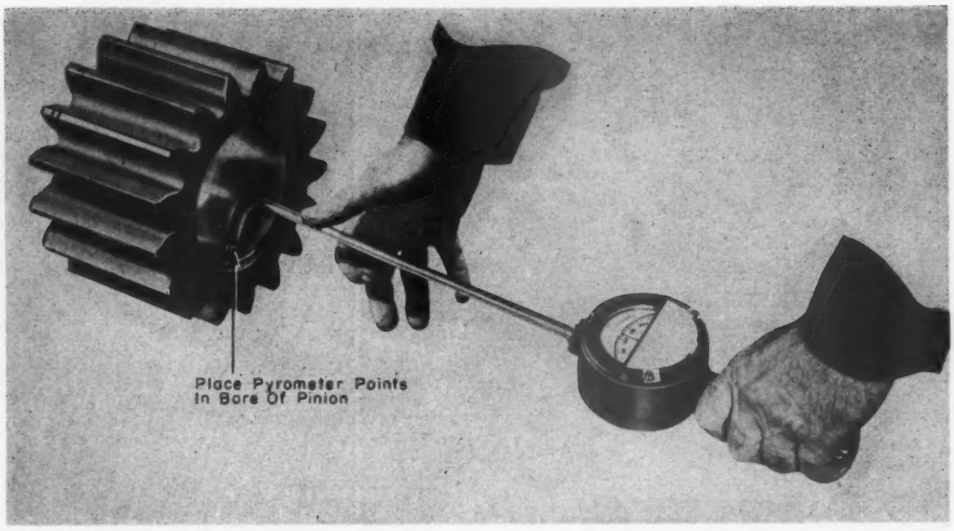


Fig. 7—Method of measuring temperature of a pinion with a pyrometer

process is repeated often enough, the compound will soon become unfit for use.

DANGER SPOTS.—It doesn't take long to ruin a good set of gears. An open cover or damaged seals can easily result in loss of lubricant or in dirt getting into the gear case. Either of these conditions will cause rapid wear of the gear teeth and quickly ruin a good set of gears. When gears wear, they develop a step at the root of the tooth, as shown in Fig. 2. This step causes interference troubles when a new pinion is matched with a worn gear. It also gives trouble when the distance between the centers of the gear and pinion is changed, as occurs with traction motors when the axle linings are replaced. All these things add up to early gear failures. By the way, failure does not necessarily occur only when the gears stop transferring power from one shaft to another. Gears fail when they stop transferring power smoothly. A set of badly worn or mismatched gears may operate for thousands of miles, but the trouble they can cause will cost thousands of dollars to repair. And that isn't a pipe dream either! Let's look at a pair of gears and see exactly what happens.

HOW GEARS WORK.—In a new set of traction motor gears, the teeth are formed with what designers call an involute shape. Because of this, the point of contact between the pinion and the gear always falls on the line of action. This line of action is in the same position as a belt would be if the gear and pinion were two pulleys. Fig. 3 serves to illustrate this.

Under these conditions, power is transmitted smoothly, the gear and pinion acting like two pulleys connected by a non-slipping belt. Therefore, when the pinion is turning at a constant speed, the gear will be driven at a constant speed. The relation between these two speeds is fixed by the relation between the sizes of the gear and pinion.

Now suppose a set of gears is so badly worn or mismatched that the involute shape is gone. When this happens, the line of action of the gear teeth is no longer constant—it jumps around like a belt on two flat-sided pulleys. The result is uneven transmission of power and vibration. For this reason, worn gears set up terrific vibrations which travel through the armature shaft of the traction motor. They enter the bearings, shortening their life. They pass through the armature core into the windings causing them to buzz, break, and wear out the insulation. They are carried through the armature head causing flanges to break, and balance weights to loosen regardless of their original strength. They pass through the magnet frame, breaking field coil and brushholder connectors. They can even cause brushes to dance and ruin commutators. Let's see what this all means. Suppose we have a bad 18-tooth pinion operating at 2,000 revolutions per minute, which is common for a traction motor. It will be pounding at the shaft at a rate of 2,000 times 18, or 36,000 blows a minute. In 30 minutes, it will have piled up a million or so healthy shocks. That is serious, and no fooling!

CAREFUL WITH THAT PINION.—Removing and replacing traction motor pinions are operations that require careful and precise workmanship. A few basic principles must be kept in mind. In the first place, the pinion is made from a special steel. It has been hardened and tempered at the factory to obtain the best possible strength and wear resistance. In removing or replacing a pinion, care must be taken not to raise its temperature above 190 deg. C. (375 deg. F.). If it is heated too much, the hardness of the pinion and its original strength and wear resistance are lowered. This will cause possible failures and rapid wear. By far the best method for removing pinions is to use either a screw type or a hydraulic puller, as shown in Fig. 4.

Sometimes an induction coil is used to heat the pinion which is then removed by wedges, forced between the pinion and the outer bearing retainer. Such methods must be used with caution. The pinion may be damaged by being heated to excessive temperatures. Also, the close running fits on the seals and flingers inside the bearing assembly may be distorted by the pressure of the wedges.

Never try to drive the armature shaft out of the pinion with a sledge because you'll surely crack the hardened thrust flanges of the roller bearing inside the motor. Fig. 5 shows the results of this in one case.

Replacing the pinion on the taper fit on the armature shaft also has its pitfalls. In order to avoid trouble, the following procedure is suggested:

1. Clean the shaft and pinion bore with solvent and remove scratches and dents that will interfere with the pinion fit. The pinion should be checked for a minimum fit of 75 per cent on the shaft. This can be done by lightly bluing the shaft, placing the pinion firmly in place and

(Continued on page 83)

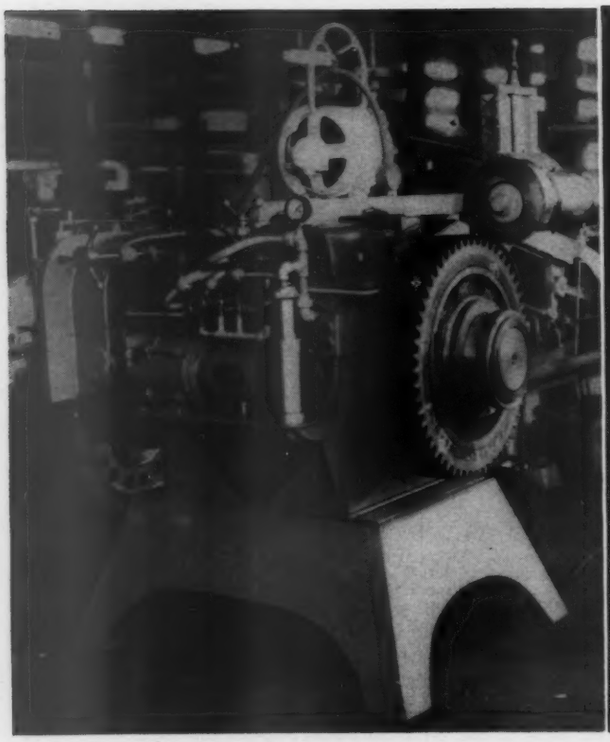


Fig. 1—Gear contour grinder built in the Burlington shops at West Burlington, Iowa

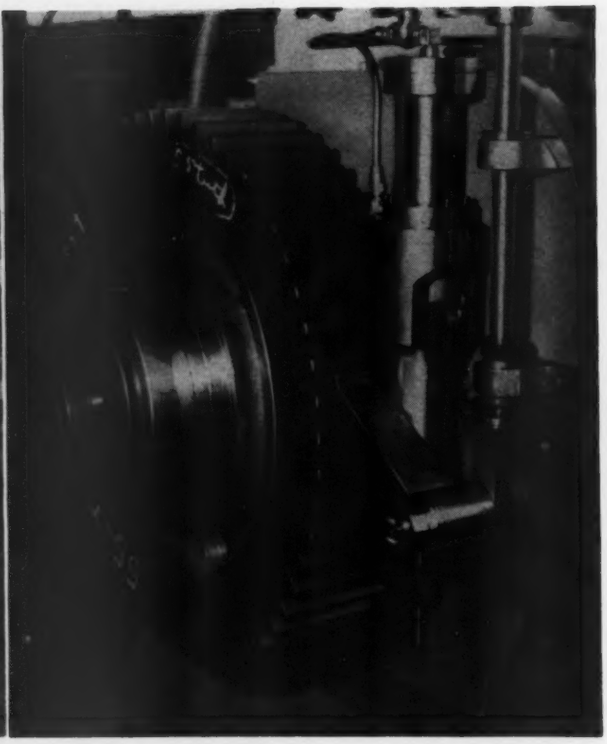


Fig. 2—A new gear is used to position the worn gear on the other end of the mandrel

Contour Grinder For Axle Gears

The Chicago, Burlington & Quincy has added a contour grinder to the list of shop tools used at its West Burlington, Iowa, shops. The grinder is completely shop designed and built, and is used to restore worn tooth contours on diesel locomotive axle gears.

The gear shown at the front of the machine in Fig. 1 is being ground. It is mounted on the shaft by means of an expanding sleeve inside the gear. Mounted on the opposite end of the shaft is a new gear of the same type as the one being ground. The new gear is used as an index positioner for the gear being ground. The manner in which this is done is shown in Fig. 2. After one

Fig. 3—Casting, templates, lathe tool, crush dresser and contoured grinding wheel

tooth has been contoured on one side, oil is admitted to the lower cylinder, Fig. 2. This advances the gears a little more than one tooth. Oil is then admitted to the upper cylinder which brings the gear back against the dog which stops and holds the gears in the grinding position.

With the gears in the grinding position, the grinding carriage is traversed horizontally along the axis of the machine, moving the contoured grinding wheel along the surface of one tooth, taking off enough metal to restore the tooth to its original contour. This is done before the loss of contour exceeds .020 in.

After the contoured wheel has made its cut, it moves back to its original position and the gear is then advanced automatically to the next tooth position. Once a set-up is made, operation of the machine is entirely automatic until the faces on one side of all teeth are contoured. The operation is then reversed and contours are restored on the other sides of the teeth. The index positioner head may be adjusted over a space of 5 in., thus providing for gears having as much as 10 in. difference in diameter.

A motor-driven pump on the machine supplies oil at a pressure of 10 lb. per sq. in. and this is used to operate the controls shown on the front of the machine, to advance and stop the gears, and to move the grinding carriage back and forth. It is also used to float the carriage on its ways.

The speed of the carriage is controlled by a throttle valve. The grinding wheel is driven by a V-belt from a 5-hp., 3,600 r.p.m. motor, mounted on the carriage. Both the gear-supporting mandrel and the grinder head run on roller bearings.

The manner in which the grinding wheel is contoured is illustrated in Fig. 3. First a lead casting s made by placing a dam around a short section of a new gear. Such a casting is shown at the left. Next to the casting are male and female templates made from the casting, and next is a lathe tool, which, with the aid of the templates, is made to match the gear contour.

The lathe tool is then used to cut the crush dresser shown between the lathe tool and the grinding wheel. Finally, a grinding wheel of rectangular section is contoured with the dresser in the same head used for grinding the gears.

Lubrication of Roller Bearings and Gears

(Continued from page 81)

turning it on the shaft fit. The resulting lines on the shaft will tell how much of the pinion was in contact with the shaft.

2. Spot the cold pinion on the shaft by hand and set the pinion advance gage at zero, as shown in Fig. 6. Chalk mark the pinion and shaft so that you can replace the pinion in the same position.

3. Heat the pinion to the temperature recommended by the manufacturer. Check the temperature with a pyrometer (See Fig. 7) in order to be sure that it is correct. Then line up the chalk marks and quickly snap the pinion on the shaft.

4. Check the advance again with the gage that was set at zero. The reading should fall within the limits given by the manufacturer. If the advance is too large remove the pinion and try it again at a lower temperature. If the advance is too small, try a hotter pinion.

A Good Fit Needed.—Railway pinions and gears, with or without keys, rely on the shrink fit to keep them from turning on the shaft. If the fit is too loose, the gearing will slip on the shaft or axle. An extra tight fit will overstress the pinion or gear, and might cause it to crack. So you can see that it is most important to do a good assembly job in order to give the gearing a good start in life. Even when gearing is properly assembled, it cannot be put in service and forgotten. Visual checks for wear limit and tooth contour should be made periodically when the opportunity presents itself. Detailed methods of inspecting gears, bearings and other equipment will be discussed in a later article.

CONSULTING DEPARTMENT

Where Do Good Foremen Come From?

In your March issue you asked how morale can be made an active factor in the diesel shop. To my way of thinking there is nothing else quite so important as the foreman in building up good morale. Now, what I want to know, is how do we find good men for foremen and how do we train them for the job?

We Need College Men—Lots of Them

Every man, whether an employee of a railroad or some other industry has personal pride. He wants to be part of a successful enterprise, and he wants to know that his efforts are paying dividends. Unfortunately, the railroads are making little money, and the hire-and-fire method of trying to get a good foreman prevails in many places. In fact foremen have had to join labor organizations to keep from being victimized by management. No foreman is happy about the situation. In the past, foremen have always considered themselves part of management, and like everyone else, they want to be proud of their job.

The result of this condition is that it is difficult to get anybody interested in taking a foremanship. The difference in pay has become so small that a couple hours overtime each week will give the worker as much as the foreman.

The usual railroad method of making a supervisor is to wave a magic wand and say to some one, "From today on you're a foreman." The usual result is that the man selected knows nothing about overhead costs, labor-hand-

ling problems, public relations, store expenses, cost of material he uses, etc.

Railroads need college men, and lots of them. They need industrial executives to bring in modern ideas, modern methods and cost accounting. When the shops are given this kind of support, and men are taken into the confidence of management, the biggest obstacles to the selection and training of foremen will be removed.

ROBERT R. BREWSTER
Chicago, Ill.

Preferably Not a College Man

The qualifications of a good foreman are that he should be a good workman at his trade and have sufficient knowledge of any trade likely to come under him to know whether the workman is doing it well or ill. He should have some theoretical knowledge, but should not be overloaded with it. He should be a man who takes an interest in the work as a whole and in his own department in particular, not merely for his own advancement.

Tact in dealing with men is the greatest essential. This can only be gained by experience. This can only be obtained by years in the shop. College or school training which put a foreman above the class of men he must control is inadvisable. The usual signs that a boy will make a good foreman are the interest he takes in his work, the respect with which he treats older and more experienced men than himself, and the ability to work well without being watched.

W. E. WARNER
Woodford Green
Essex, England

Diesel-Electric Locomotive Batteries

Questions and Answers

Q. How can the battery and its compartment be kept clean?

A. It is important that the battery be kept clean. If dirt or acid-soaked mud accumulates on top of the battery, it is an unpleasant job to handle and will eventually cause trouble.

Electrolyte spilled on the battery cell covers, trays or battery compartment, never dries or evaporates. It rots the wood trays, causes grounds, and corrodes any metal parts that are subject to attack from sulphuric acid.

If, during a monthly inspection, the top of a battery is found to be damp with electrolyte, the Electric Storage Battery Company's service engineers suggest that it be neutralized with a solution of commercial bicarbonate of soda, consisting of one pound of soda to a gallon of water. For best results apply the soda solution freely, preferably hot, with a paint brush. The brushing action tends to remove the oil film usually found on tops of diesel locomotive batteries. This is important, because the oil sometimes traps a certain amount of acid on battery cell covers.

Keep vent plugs in place. *Do not allow any of the soda solution to get into the cells. It will neutralize the electrolyte and lower cell capacity.* Sufficient time must be permitted for neutralization. Wait until foaming stops on electrolyte soaked areas, especially on wood trays, and then immediately rinse off with water at moderate pressure, to remove the soda solution. If soda is allowed to dry on top of the battery, it produces a path for current leakage. Allow to air-dry.

During a regular monthly inspection, if the top of a battery is found to be dry but dusty, it should be rinsed off with water at moderate pressure as shown.

In freezing weather, after rinsing the top of a battery and, if there is not sufficient time for air drying in the shop, low pressure air should be used to blow off the surplus water.

Do not use steam or high pressure air for cleaning or drying, because both will remove the protective grease from the grease ring seal nuts on the posts. This grease prevents electrolyte corrosion of the copper lugs, cables and connector bolts attached to the posts. Steam also tends to remove the protective coating of paraffin and paint from the woodwork, and may damage the sealing between the jar and cover to the extent that resealing might be necessary to prevent loss of electrolyte.

Increase water pressure to wash out battery compartment and dirt from under battery trays. This helps to prevent grounds.

S. K. LESSEY
The Electric Storage Battery Company

Using low pressure water to hose down a locomotive battery

EDITORIALS

Safety in Operation of Wrecking Outfits

Railroads generally prefer the term "derailment" to "wreck" for obvious reasons and yet the special train and equipment used in replacing derailed cars and locomotives or otherwise clearing blocked tracks for operation are commonly called "wreck trains," or "wrecking outfits." In discussing this subject at a meeting of the Car Foremen's Association of Chicago early this year, A. F. Waddell, wrecking foreman of the New York Central at Englewood, Ill., made a number of suggestions in the interest of safety which may well be elaborated.

The first consideration at the scene on a derailment is the safety of all present. This means keeping spectators at a reasonable distance. It also means the use of standardized, pre-tested equipment and tools of all kinds on the wreck train, kept in specified locations where they can be quickly found and easily made available at a moment's notice. Above all, a wrecking foreman is needed who has the ability to size up conditions at any derailment and the experience to know what general procedure is likely to restore the line to operation with the least possible delay and damage to equipment and other railroad property, and whose decisions are never hasty but are, none-the-less, arrived at quickly. It was testified at the meeting that no competent wrecking foreman will ask any member of his crew to go into a place or do any job he would not do himself. As a result of all of these qualities wrecking crews learn to have confidence in the judgment of their supervisors and to obey instructions promptly and willingly.

Other important considerations are the question of authority at the scene of the derailment, and the method of transmitting signals. Since there cannot safely be more than one "boss" in an operation of this kind, the wrecking foreman generally is given full authority and responsibility. To give him less is dangerous and likely to result in confused procedure. He alone issues instructions, or gives signals for each move to be made. As a further precaution against confusion in signals from unauthorized persons during night operation, one practice successfully followed has been for the wrecking foreman to use a personal and exclusive colored light, such as green, in passing signals to the crane man and directing general operations.

One comparatively new problem which confronts wrecking crews to an increasing extent as diesel motive power becomes more widely used is how to get this type of locomotive back on the rails quickly and with the least possible damage. In extreme cases, the locomotive may actually have to be rolled and considerable damage is unavoidable. In other instances careful jacking or lifting at the jacking pads accomplishes desired results with little or no damage to the locomotive. Judging from discussion at the meeting, it is difficult to rerail a diesel locomotive by direct pull without damage to gear housings, traction motors and brake rigging, especially when rails are high. If pulling is the only method feasible to use, it was suggested that power judiciously applied to diesel wheels at the same time will help.

When a road diesel is practically in line with the track and must be approached by the wrecking crane directly from one end, it is sometimes found impossible for the crane hook to reach far enough to make the lift from jacking pads without damaging the front end, or end vestibule. In this case experience shows that a simple lifting yoke of proper design may be applied to the end coupler and permit making the lift from this point without bending the coupler or damaging the coupler horn and head block. In all cases of doubt regarding the lifting capacity with the crane boom at various angles, carefully blocked outriggers are an obvious necessity. Safety in this respect must depend upon the experience of the wrecking foreman and thorough knowledge of his equipment.

How Many Tests Do Repaired Parts Need?

Railroads can spend far too much time and money on testing repaired parts or parts removed for inspection. They can also spend so little that operation is plagued with road failures, the measurable damage alone from which can cost dollars for every penny saved by cutting inspection costs. Striking a balance between inadequate testing and overly elaborate testing is oftentimes as difficult a task as it is vital.

For two good reasons, shops are more likely to err on the side of inadequate testing. One, of course, is the pressure to get the work out on time. The second is that shops frequently lack the equipment to do the job thoroughly and efficiently. Without the high production volume of a manufacturing industry, a railroad cannot too easily justify elaborate equipment for quality control purposes.

When, in some instances, such elaborate and expensive equipment is acquired, there can exist a natural tendency to overrate it because the new equipment is far better than anything else that was used before, and because it is often far more impressive than any other piece of equipment in the shop.

When, then, defects do occur on parts that have been inspected, they are likely to be considered to have originated after inspection, without determining if perhaps the machine was improperly operated or whether the defect was outside of the scope of the machine to detect. Neither condition is always easy to find, but both prob-

ably exist to a greater extent than generally realized.

A good example of the latter can be found on a road that had difficulties with diesel cylinder heads and liners failing in service, frequently only a short time after being overhauled. Testing diesel-engine heads with cold water at 60 p.s.i. detected the cracks that Magnafluxing missed, and virtually eliminated road troubles from this source. This is a good example of how a supplementary test can be useful. There are probably many other instances where a supplementary test would be of equal value in detecting the small percentage of defects that the main test fails to locate.

Gear Contour

A little over a year ago, a railroad which had developed an enviable record for doing good traction-motor repair work at low cost, began to lose that record at an alarming rate. It had been getting 900,000 miles of service between motor rewinds and this fell off so that some motors failed to make 100,000 miles. New motors did not do as well as those overhauled in the shop. Insulation failed and the copper in the coils broke, with resultant motor failure.

Many explanations were offered, but none of them has so far afforded a solution to the difficulty. The latest of these was the correction of a practice which permitted the use of three different axle sizes on a single size of motor support bearing. This resulted in as many as three steps on the contour of gear teeth, and could have caused damaging high-frequency vibration. Other operating practices may also have contributed to short motor life, but this cause has been reduced to the extent of matching axles and bearings, and performance improvements are anticipated.

Manufacturers have long recommended keeping a pinion and its gear together throughout the life of the pinion, but railroads have found this impracticable. A development on the Burlington offers a possible means of improving performance of gears and motors in any application. It consists of a shop-made machine, described in the electrical section of this issue, which not only removes the steps from gears, but also restores their original contour.

It has long been suspected that vibration in service, particularly if it is of relatively high frequency, causes insulation and perhaps the copper of coils to deteriorate rapidly. If records can be kept to show relative performance of motors operating with gears which are kept in contour, and motors operating with gears which are not, it may result in an important contribution to the reduction of motor maintenance costs.

NEW BOOKS

THE STEAM LOCOMOTIVE OF TODAY. *By M. P. Sells, O.B.E., M.I.Mech.E., M.I.Loco.E. Published by The Locomotive Publishing Co., Ltd., 88 Horseferry Road, Westminster, S.W.1. 250 pages, 5 in. by 8 in.*

A part of this book was originally written in 1934 for the African Locomotive running staff of the Nigerian Government Railway and was first published in 1936 under the title "How the Locomotive Works and Why." The book now includes some notes on shop practice, tolerances, scrapping sizes, clearance limits, etc., as well as new and enlarged diagrams. Its chapters discuss fuel and its combustion; evaporation of water into steam; principles of expansion of steam and work done during expansion; tractive force; brakes and brake equipment; lubrication; locomotive failures; duties of firemen and enginemen, etc.

VIBRATION AND SHOCK ISOLATION. *By Charles E. Crede. Published by John Wiley & Sons, Inc., 440 Fourth avenue, New York 16. 328 pages, 6 in. by 9 in. Price, $6.50.*

The information in the six chapters of this book for the practicing engineer has been compiled from technical literature and commercial brochures, supplemented by experience gained from engineering practice. It concentrates on the principles of isolation and the design of isolators, rather than on general vibration theory and practice. Isolation is treated both from analytical and descriptive points of view. The causes of vibration and shock are analyzed and the use of natural and synthetic rubbers, metal springs, felt and cork for designing isolators evaluated. Train and road-vehicle installations are among the particular applications of isolators discussed in Chapter 6.

THE PRACTICAL ENGINEER POCKET BOOK, 1951. *Edited by N. P. W. Moore, B.Sc., A.G.G.I., D.I.C., A.M.Inst.F. Published by the Pitman Publishing Corporation, 2 West 45th Street, New York. 744 pages, Price, $3.*

The internal combustion engine section of this edition of the Pocket Book, a publication prepared in Great Britain, has been extended to include information on the properties of compression ignition fuels, and a brief section has been added on the supercharging of engines. A section has also been included on the gas turbine. Provisional basic data on the proposed unified standard screw threads have been included, and the revised list of British technical journals has been supplemented with a selected list of American journals. A German dictionary has been included with the technical dictionaries in French and Spanish. Among the other subjects covered in the 22 sections of the book are steam and steam generation, the steam engine, locomotive practice, steam turbines, condensers, gas and oil engines, air compressors, air and ventilation, welding and cutting, etc.

NEW DEVICES

▲ Side door protection is provided for all kinds of freight, and the expense of barricading the regular car door is eliminated

◀ When the door is in the raised position, opening is not obstructed in any way

▼ Door stored out of the way

Permanent Grain-Tight Door

A permanently installed grain-tight door now available for application to box cars prevents the loss of wheat, corn and other bulk commodities during shipment, and serves as side-door protection to freight in boxes, crates, bales and sacks. In addition to reducing loss and damage, the door, being a permanent installation, further eliminates the problems and expenses involved in purchasing, handling and installing the side door protection required for many shipments. No further cost is incurred by either the shipper or the railroad for barricading the door.

This device, named the Utility All-Purpose Door, operates on the same general principle as the modern overhead garage door. It is completely out of the way when not in use; one door nests over the other close to the roof of the car leaving the regular side doorways unobstructed for loading or unloading.

All hardware is disposed outwardly from the inside surface of the car, thus presenting a smooth, continuous surface to prevent damage to freight due to contact with door posts. For easy operation the doors are individually counter-balanced by a torsion spring and drum arrangement. Before being placed in service all operating hardware was given an accelerated lifetime test of 5,200 full opening and closing cycles on a full size model.

The door consists of a pair of overhead doors operating on floating rollers running in steel channel tracks sturdily designed to withstand the normal impacts that might be expected during loading and unloading. Each door consists of a series of wood panels joined together, with a total height of 80 in. and extending across the width of the side door opening. If side-door protection above 80 inches is required, provision has been made for hooking the operating cables to the door posts so that a supplementary grain door can be nailed to the door posts on the inside of the car at the top of the utility door.

Additional protection against leakage is afforded by the arrangement of hinge plates on the insides of the door posts, sealing strip at the bottom, and the ship-lap construction of the wooden panels.

A small relief door is incorporated near the bottom of the Utility All-Purpose Door for unloading grain or other bulk commodities. Opening this relief door and allowing the grain to run out for a few minutes reduces the pressure against the main door, permitting it to be raised easily.

Twelve carload shipments were tested in a Burlington car using this door with an average length of haul of 370 miles. Ten of the shipments were grain in bulk—eight loads of wheat and one each of corn and mixed grain—with a weight average of 122,000 lb. No appreciable loss of grain was reported in any shipment. Two miscellaneous loads, were also tested, one carload of 800 100-lb. paper sacks of sugar and one of a full carload of empty tin cans. There was no damage to either shipment.

Speed in loading was demonstrated one day at Yuma, Colo., when the test car equipped with the Utility All-Purpose Door was brought in on the local freight and

spotted at the elevator. Before the balance of the station switching was done, the car was loaded, ready to move.

The Utility All-Purpose Door is a product of the Richards-Wilcox Manufacturing Company of Aurora, Ill., represented by I. W. Preetorius, freight traffic consultant, and F. F. Frye, 20 No. Wacker drive, Chicago.

Oxy-Acteylene Cutting Blowpipe

The ease which which this giant size hex nut, for a 250-ton hydraulic press at the plant of the General-American Transportation Co., Sharon, Pa., is cut to shape by the oxy-acteyline cutting process is graphically illustrated here.

The Oxweld C-37-R Cutting Blowpipe, developed by the Oxweld Railroad Service Co., Division Union Carbide & Carbon Corp., New York 17, easily slices through the 24 in. low-carbon steel billet at the rate of 3 in. per min.

In processing the giant nut, a hole was first cut out of the center of the block whose sides are then cut in the shape of a hexagon. After being cut into shape, the nuts are threaded for colmun bolts in a hydraulic press. No other machining is necessary.

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Printed Straw Slot Dixie Cup Lid

The Dixie Cup Co., Easton, Pa., has announced a new printed straw slot lid for Dixie Cold Drink Cups to replace its plan tab lid.

The straw slot is a U shaped, liquid-tight opening designed to meet the demand from airlines, railroads, and other similar customers concerned with the danger of drinks spilling. To insert a straw, the user simply presses in with finger or straw.

All lids will be treated after the straw slot is cut, making them substantially spill-proof for use in the normal manner.

◆

Vaporization-Cooled Transformers

A vapor-cooled, vapor-insulated transformer that is expected to be ¼ to ⅓ lighter than liquid-immersed units of equivalent rating and performance is being developed by the Westinghouse Electric Corporation. The new cooling technique that utilizes the heat of vaporization of liquid fluorocarbons for cooling and the dielectric strength of fluorocarbon vapor for insulating, is a joint development of the Transformer Division and the Research Laboratories. Cooling is effected by spraying liquid fluorocarbon over core and coils. It then forms a vapor which fills are spaces in the tank. The vaporized fluorocarbon in turn is forced through cooling tubes and returned to the sump as a liquid.

Fluorocarbons have a suitable boiling point and heat of vaporization, and they have a high dielectric strength and impulse strength at low pressures. In fact, the 60-cycle dielectric strength of fluorocarbons in a reasonably uniform field at atmospheric pressure is greater than that of transformer oil.

Two vaporization-cooled transformers have been constructed and operated. The first experimental unit was a modified standard dry-type transformer. Equipped with adequate cooler capacity, the unit delivered in excess of 350 per cent of its rated capacity, dissipating ten times more heat than a dry-type transformer could have.

The second experimental unit, a specially-constructed 500-kva., $^{2400}/_{240}$-volt transformer, has been operating at rated load since the first of the year.

A vaporization-cooled trasformer should be safe or safer than liquid-immersed or dry-type transformers because the fluorocarbon liquid is not only non-inflamable, but has fire-extinguishing properties. Heat transfer by vaporization is far superior to that obtained with circulating oil. Therefore, it is possible to design a more compact coil assembly and to reduce the external cooling surface.

Where a degree of safety is required that is not obtainable from liquid-immersed transformers, where space and voltage requirements rule out dry-type transformers, and where extremely compact installations with forced external cooling or a remote cooler are required, a vaporization-cooled transformer may provide the most suitable and economical answer.

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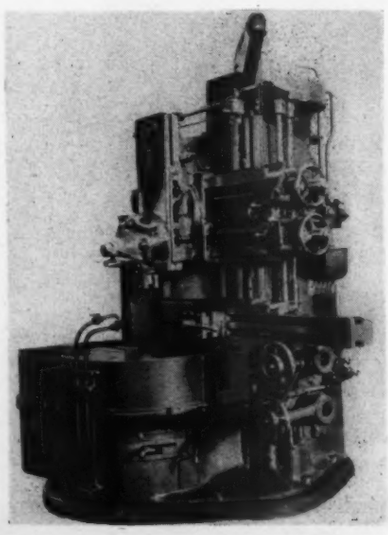

Vertical Boring and Turning Mill

A Niles 42 in. vertical boring and turning mill with side head is now available for heavy-duty production, maintenance and job shop operations. Known as the Side Head Mill, it has been modernized by increased table speeds and corresponding feed changes; by use of anti-friction bearings in the table speed change gear box and table mounting; and by a higher powered drive from a 30-hp. motor.

The unit combines the advantages of a turret lathe, engine lathe, and vertical boring and turning mill, with independent or simultaneous engagement of down and

cross feed or power traverse for both rail head and side head.

Accuracy of this machine announced by the Baldwin-Lima-Hamilton Corp., Hamilton, Ohio, is provided by several features including integrally cast column and base, a three-track coss-rail and an elevating screw adjacent to the narrow guide. A center stop which locates the rail head and maintains alignment between it and the center line of the table spindle is an important feature essential for accurate boring with double head cutters, for drilling and reaming.

Actual swing with side head down is 50 in. Maximum distance from table top to turret face is 48 in. The vertical head, which has five faces, has a slide travel of 28 in. and will swivel 45 deg. to either side of vertical position. The side head, which has four faces, has a vertical working travel of 35 in. and a horizontal travel of 21 in.

There are 12 table speeds ranging from 9 to 200 r.p.m. and 16 feeds for either vertical or side head between 0.003 and 0.520 in. per revolution of the table. This machine occupies a floor space 8 ft. 4 in. wide by 8 ft. 10 in. deep and stands 10½ ft. high.

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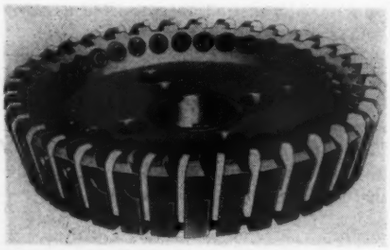


High Speed Axial Face Mill

Recently introduced for general purpose and continuous production milling is the simplified axial face mill, style MF Kennamill by Kennametal Inc., Latrobe, Pa. Having wedged-in blades and structural features, the mill makes possible the removal of cast iron at from 60 to 70 in. of the table travel per min.

This mill has four parts: body, blades, wedges and nuts. The wedges and screws are a one-piece alloy steel and remain assembled to the cutter body at all times, reducing the possibility of lost parts.

The blades are heavy, solid, and wedged-in. No hammers or special tools are needed to tighten them, a simple hex wrench suffices. Blades are available in two styles —for cutting to a square shoulder or to a 45 deg. corner. They are interchangeable in all slots of any size of cutter body of the same type. Wedges are round and are interchangeable in any slot of any size cutter, either right- or left-hand. They do not have to be pried out, but can be readily loosened with a soft hammer.

The face mill is made in seven cutting diameters: 6, 8, 10, 12, 14, 16, and 18 in.; either right- or left-hand.

Battery Charger For Shelf Mounting

A motor-generator type battery charger, designed to permit mounting on balconies or shelves to save floor space, has been announced by General Electric's Small and Medium Motor Divisions.

For charging batteries in driver-lead and small driver-ride industrial lift trucks, the new unit accommodates lead-acid batteries of 6 to 19 cells and nickel-iron-alkaline batteries of 10 to 30 cells. It is about the size of a tank type vacuum cleaner with a control box mounted on its side, weighs 190 lb., and can be installed on a shelf measuring 6¾ in. x 8¼ in.

To place a battery on charge, it is only necessary to plug it in, and set the timer; automatic controls do the rest. Voltage based on the number of cells) and current based on ampere-hour battery ratings) are adjustable.

Protection from external damage to the charger is provided by completely enclosed construction. Permanent bearing alignment, established by factory assembly, cannot be disturbed during mounting. Incorporated in the design of the new unit are a number of features recommended by the Industrial Truck Association. Included are: automatic disconnection of charger from power line and opening of charging circuit in case of power interruption, automatic restart of charger upon resumption of power supply following an interruption, automatic control of charging rate under the modified constant voltage charging system, and automatic cut-off of battery and shutdown of charger when the battery is fully charged.

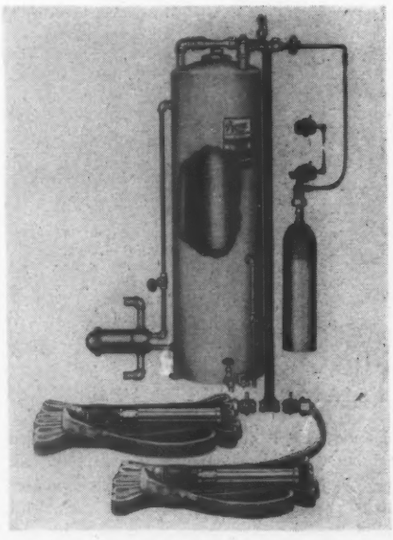
The single-circuit equipment operates on 3-phase, 60-cycle, a.c. power, and has generator-overload and motor-overload protection to guard against excessive currents.

Self-Contained Air Foam System

Completely independent air foam fire extinguishing system for locations without water supply or adequate water pressure has been announced by the Pyrene Mfg. Co., Newark, N. J. A number of railroads have equipped all of their diesel locomotives with this foam system.

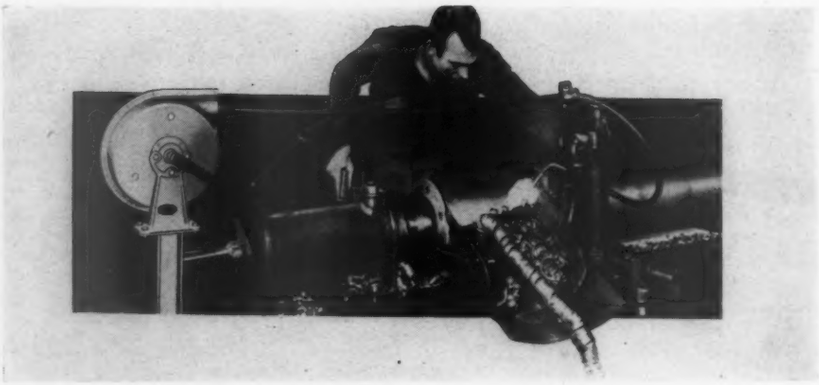
The system illustrated shows a typical installation for a diesel locomotive which may be operated by one man from either side of the locomotive. Operation is started by pulling a handle in the manual control pull box which releases gas from a carbon dioxide pressure cylinder to provide pressure within a water tank. The discharging water passes through a foam compound into the water stream.

The mixture of water and foam compound are then discharged to the Pyrene Foam Playpipe. At the playpipe, the mixture is converted into air foam or mechanical foam which flows over the surface of blazing liquids or blankets burning solids to shut off the supply of oxygen and smother the fire. The 100 gal. of water and 6 gal. of foam compound carried in the unit will produce as much as 1,750 gal. of foam at the rate of 350 gal. per min.



This unit is compact and occupies only 24½ x 24½ x 70 in. and when fully charged weighs approximately 1,600 lb.

In case of derailment, the system will operate even in a horizontal position. If protection against freezing is needed for a diesel locomotive installation, a heat exchanger as shown may be used.

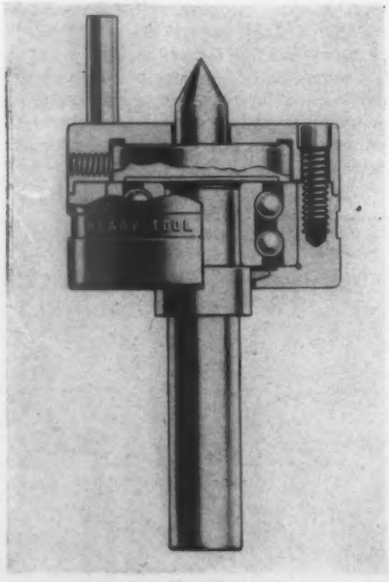


Machine Tool Hose Reel

An important new application of a Wayne Hose Reel to machine tool operation has been perfected by The Wayne Pump Co., Fort Wayne 4, Ind. The hose reel may be used with water, fluid lubricants or coolants.

A standard reel is attached to the end of a lathe or other machine requiring the addition of a coolant. The liquid is fed into the reel and through the hose to the cutting tool head. The hose moves automatically, following the tool with cooling liquid allowing the operator to give full attention to his work.

This hose reel is a compact unit which can be mounted anywhere on the machine tool. In addition to the uses described above, it may be used as a bench reel to supply portable air tools. It provides bolt tool suspension and air supply in one unit.



Floating Type Anti-Friction Center

An adjustable floating type center, with which expansion type hand reamers can be correctly ground, so that the reamer teeth will be concentric with the front pilot surface, has been developed by the Ready Tool Co., Bridgeport 5, Conn. This operation is done simply, in a universal tool and cutter grinder, eliminating a cylindrical grinding operation.

The method of grinding expansion hand reamers, using this center is to first adjust the expansion plug of the reamer so that the highest micrometer reading obtainable is from 0.002 to 0.004 in. over the nominal size. Since hand reamers are always ground with a taper or lead, in order to allow them to enter holes freely and without chattering, the swivel table is readjusted to produce the desired lead. Each blade is then backed off, so as to leave practically a sharp cutting edge.

The amount of lead depends upon the amount of stock to be removed by reaming and is, generally, from 1/16 to 3/8 in. per ft. and approximately 1/2 in. in length for reamers up to 2 in. in diameter and 3/4 in. in length for larger sizes.

These centers are available in various tapers or straight shank sizes and can be adapted to any type of universal tool and cutter grinder.

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Self-Contained Ring Packing

A new automatic ring packing called Uneepac, has been developed. It is a molded packing and each ring is a complete, self-contained packing unit.

According to the manufacturer, the product is valuable in the design of new equipment and opens the way for many desirable savings. It is designed for maximum sealing efficiency in minimum packing depth so stuffing box sizes can be reduced. No follower or header rings are needed.

Each ring centers itself perfectly on the preceding ring. This reduces the chance of human error. In service, each lip is always exposed to fluid pressure which provides instantly responsive, positive sealing. Since Uneepac does not depend on gland pressure for sealing, friction is reduced and there is less wear on both rod and packing.

Manufactured by Johns-Manville, New York 16, it is offered in varied compositions to suit different services—water, steam, oil, air, gas, vacuum and so forth. The packing is furnished in sets of endless or split rings and is available for shafts 5/8 in. diameter and up.

Self-Locking Sleeve Fastener

Created to reduce labor costs, a one-man expansion sleeve bolt fastener has been made available by the Chicago Drillet Division, Square Tool & Die Co., Chicago 22. Primarily, it eliminates the helper required in inserting and tightening up the conventional bolt and nut as no nut is utilized.

The bolt is simply inserted into its hole. A pneumatic tool drives the bolt through its sleeve and expands 6 prongs at the bottom of sleeve. This forms a tight grip which cannot work loose due to vibration.

The device is made in diameters from 1/4 in. to 1 in. and in lengths from 1 in. up with hex, square, round, flat or slotted heads.

Hand Operated Air Grinder

An air grinder, announced by the Ingersoll-Rand Co., New York 4, has an added safety device to prevent overspeed operation and possible accidents. This unit has special application in foundries, steel mills, and metalworking plants where hand grinding is required for snagging, trimming, smoothing, etc.

The device contains a motor governor to maintain correct wheel speed, plus a built-in unit called the overspeed safety coupling. In case the motor overspeeds because of governor wear, abuse, maladjustment or dirty air, this coupling automatically uncouples the arbor and the grinding wheel from the motor, making it impossible to operate the grinder until the cause of overspeeding has been corrected.

Another safety feature is a multiple exhaust system. The operator can choose any one of four exhaust positions, spaced 90 deg. apart, and thus direct exhaust away from work and from his own body.

In addition, it has a safe-carrying grip type handle which is designed with enough space between the throttle lever and the back of the handle for a comfortable hand hold.

The grinder is available for 8, 6, or 5 in. wheels, running at respective motor speeds of 3,100, 4,100 and 4,500 r.p.m. Overall length is 24⅝ in. with straight handle and 22½ in. with grip handle. Maximum side to center distance is 2-5/16 in. and it weighs approximately 16½ lb. with guard.

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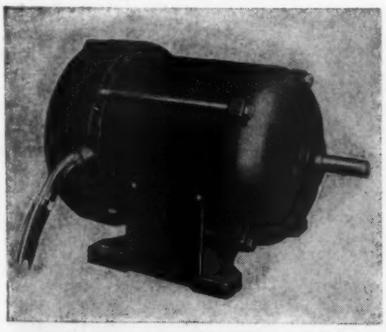

Totally Enclosed Capacitor Motors

General Electric's Tri-Clad line of single-phase capacitor motors has been extended to include a totally enclosed fan-cooled construction. Features of the new design include starting capacitors and a switch mounted within the frame to provide maximum protection with minimum space requirements.

Available in ratings of 1, 1½, 2, 3, and 5 hp., the new line was developed for use where extra severe conditions of dirt, grit, or moisture are encountered. It is also offered in explosion proof and dust-explosion proof construction for installation in hazardous locations. Typical applications are: coal stokers, exhaust fans, grain elevators, and fuel pumps.

Of cast iron construction, the new motors feature the standard Tri-Clad protection against physical damage, electrical breakdown, and operating wear and tear. Being capacitor motors, they have no brushes or commutators to interfere with radio or television reception.

The motors have cast aluminum squirrel-cage rotors and are equipped with long-life ball bearings which will run for years without attention. Easily accessible grease fittings simplify relubricaion when it does become necessary.

Except for the 5-hp. size, which uses 230 volts only, the new motors operate on 115/230-volt, 60-cycle power supply.

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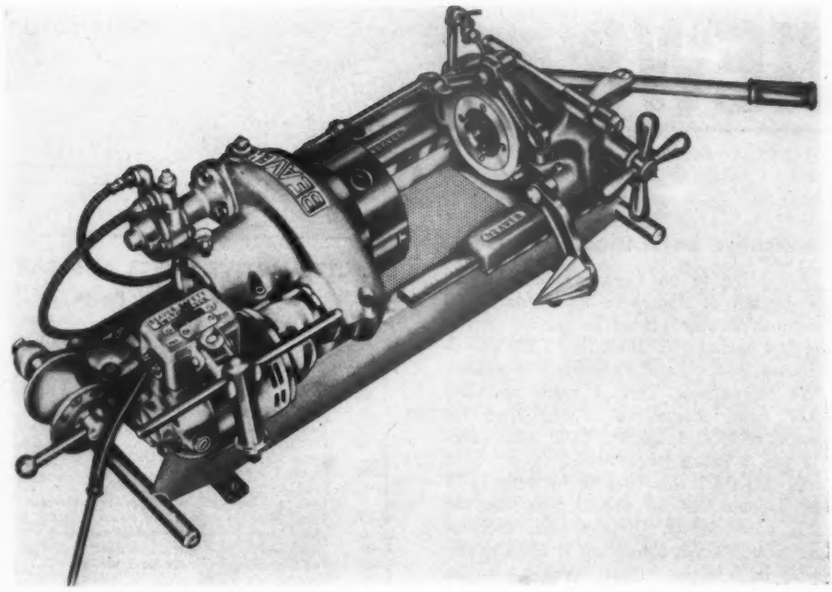


Pipe Threader Has Safety Device

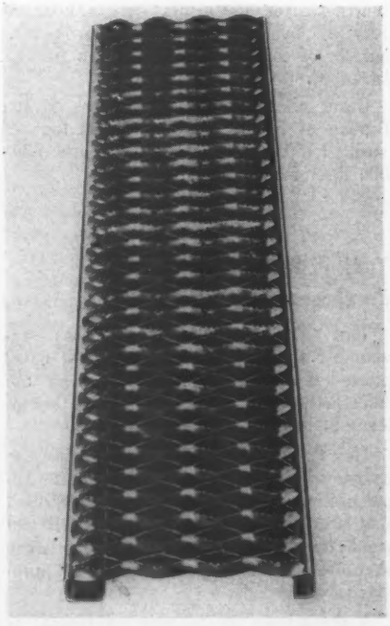
The model "E" lightweight economy model manufactured by Beaver Pipe Tools, Inc., Warren, Ohio, is now equipped with a Safety Switch Lock. Adding this feature gives the pipe tool the same advantages as the larger and more expensive models A and B. To complete the picture, power units C1 and C2 are also protected with the same safety switch lock.

This switch lock is an important device protecting workmen, as well as machine, against possible injury. With the device it is impossible to start the model E unit unless chuck wrench has been removed from the chuck and placed in its holder. This feature replaces the old-style ejector that ejected only special types of wrenches. Now, no special wrench is required.

Anti-Skid Strut Grating

The production of a new development called Grip-Strut Grating has been announced by its manufacturer, The Globe Co., Chicago. Its descriptive name is derived from the nature of the product which presents an anti-skid surface on the edges of a series of formed struts.

Strength coupled with light weight recommends it for uses such as railroad running boards, cat walks, work platforms, etc. Metal for forming into longitudinal channels, step risers, step nosing or mouldings is integral with the grated surface, eliminating the need of welding in many applications.



This one piece grating appears as a diamond shaped pattern in which the percentage of open area is in excess of 75 per cent of the total recticulated surface.

(Continued on page 118)

NEWS

Locomotive Installations

According to an announcement by the Association of American Railroads. 1,309 locomotives were placed in service during the first half of 1951 including 1,229 diesel-electrics, 8 steam and 2 electric loromotives.

By comparison, Class I roads installed 1,127 new locomotives in the first six months of 1950, including 1,122 diesel-electric and 5 steam locomotives.

As of July 1 this year there were 1,674 new locomotives on order, consisting of 2,251 power units. Diesel-electric locomotives totaled 1,658, consisting of 2,223 power units. In addition, there were 14 steam locomotives and 2 electric, the latter consisting of 4 units.

New locomotives on order on July 1 last year totaled 1,000, of which 973 were diesel-electric, 23 steam and 4 electric.

D. P. A. Announces 4th Quarter Allotments

THE railroad program has been allotted 1,872,425 tons of steel, 64,355,000 lbs. of copper, and 8,500,000 lbs. of aluminum under the Controlled Materials Plan for this year's fourth quarter. This and other fourth-quarter allotments were announced July 27 by Manly Fleischmann, administrator of the Defense Production Administration.

Other allotments included those to the Bureau of Public Roads—250,050 tons of steel, 1,150,000 lbs. of copper, and 520,000 lbs. of aluminum.

T. C. Plans for Equipment Purchases in Fiscal '52

THE Transportation Corps has announced that it plans to purchase 6,040 pieces of railway equipment during the 1952 fiscal year. Total cost of this equipment is estimated at $115,267,685.

The T. C. outlined its plans during the course of hearings before the House Appropriations Committee. It is understood that acquisition of this equipment will depend "on how the national steel picture shapes up," assuming that Congress appropriates the money.

A breakdown of the new equipment is as follows:

426	diesel-electric locomotives	$69,490,000
57	railway cranes	2,926,000
2,312	boxcars	10,638,000
100	refrigerator cars	800,000
878	flatcars	9,240,000
648	tank cars	4,366,000
1,208	open cars	4,876,000
254	inspection and maintenance cars	176,685
147	special cars	12,755,000

During the hearings before the House

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item	No.		Month of April 1951	Month of April 1950	4 months ended with April 1951	4 months ended with April 1950
3		Road locomotive miles (000) (M-211):				
3-05		Total, steam	26,341	28,580	108,774	107,076
3-06		Total, Diesel-electric	21,784	16,678	82,750	63,549
3-07		Total, electric	858	858	3,274	3,193
3-04		Total, locomotive-miles	48,984	46,124	194,815	173,837
4		Car-miles (000,000) (M-211):				
4-03		Loaded, total	1,755	1,573	6,865	5,790
4-06		Empty, total	920	889	3,370	3,174
6		Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01		Total in coal-burning steam locomotive trains	45,835	49,987	184,636	169,619
6-02		Total in oil-burning steam locomotive trains	13,048	10,563	48,545	43,367
6-03		Total in Diesel-electric locomotive trains	61,499	47,553	230,610	178,472
6-04		Total in electric locomotive trains	2,330	2,350	8,940	8,305
6-06		Total in all trains	122,720	110,493	472,812	399,845
10		Averages per train-mile (excluding light trains) (M-211):				
10-01		Locomotive-miles (principal and helper)	1.04	1.05	1.05	1.05
10-02		Loaded freight car-miles	39.70	38.00	39.20	37.10
10-03		Empty freight car-miles	20.80	21.50	19.30	20.40
10-04		Total freight car-miles (excluding caboose)	60.50	59.50	58.50	57.50
10-05		Gross ton-miles (excluding locomotive and tender)	2,775	2,671	2,701	2,566
10-06		Net ton-miles	1,287	1,201	1,262	1,147
12		Net ton-miles per loaded car-mile (M-211)	32.40	31.60	32.20	30.90
13		Car-mile ratios (M-211):				
13-03		Per cent loaded of total freight car-miles	65.60	63.90	67.10	64.60
14		Averages per train hour (M-211):				
14-01		Train miles	17.30	17.10	16.80	17.00
14-02		Gross ton-miles (excluding locomotive and tender)	47,430	45,044	44,792	43,027
14		Car-miles per freight car day (M-240):				
14-01		Serviceable	47.70	46.20	46.00	42.00
14-02		All	45.60	43.00	43.90	39.00
15		Average net ton-miles per freight car-day (M-240)	971	868	947	778
17		Per cent of home cars of total freight cars on the line (M-240)	36.50	43.70	35.30	47.50

PASSENGER SERVICE (DATA FROM I.C.C. M-213)

3		Road motive-power miles (000):				
3-05		Steam	10,307	11,938	44,537	44,536
3-06		Diesel-electric	15,821	14,217	62,052	55,859
3-07		Electric	1,601	1,609	6,452	6,364
3-04		Total	27,729	27,765	113,040	106,760
4		Passenger-train car-miles (000):				
4-08		Total in all locomotive-propelled trains	269,197	263,289	1,090,212	1,028,779
4-09		Total in coal-burning steam locomotive trains	53,800	62,445	235,591	224,759
4-10		Total in oil-burning steam locomotive trains	32,486	33,350	134,358	138,146
4-11		Total in Diesel-electric locomotive trains	165,621	149,854	651,301	596,076
12		Total car-miles per train-miles	9.52	9.26	9.51	9.38

YARD SERVICE (DATA FROM I.C.C. M-215)

1		Freight yard switching locomotive-hours (000):				
1-01		Steam, coal-burning	1,237	1,445	5,326	5,530
1-02		Steam, oil-burning	247	207	987	874
1-03		Diesel-electric[1]	2,895	2,393	11,453	9,205
1-06		Total	4,405	4,070	17,872	15,713
2		Passenger yard switching hours (000):				
2-01		Steam, coal-burning	50	61	211	251
2-02		Steam, oil-burning	13	12	54	51
2-03		Diesel-electric[1]	239	222	952	882
2-06		Total	337	329	1,351	1,320
3		Hours per yard locomotive-day:				
3-01		Steam	7.80	7.80	8.20	7.50
3-02		Diesel-electric	17.60	17.60	17.70	17.30
3-05		Serviceable	14.40	14.00	14.60	13.80
3-06		All locomotives (serviceable, unserviceable and stored)	12.40	11.70	12.60	11.30
4		Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.73	1.79	1.79	1.87
5		Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.78	0.77	0.77	0.80

[1] Excludes B and trailing A units.

SUMMARY OF MONTHLY HOT BOX REPORTS

Month	Foreign and system freight car mileage (Total)	Cars set off between division terminals account hot boxes: System	Foreign	Total	Miles per hot box car set off between division terminals
July, 1950	2,745,932,894	—	—	23,957	114,619
Aug., 1950	2,937,455,020	7,422	15,490	22,913	128,206
Sept., 1950	2,974,297,739	6,541	12,881	19,422	153,141
Oct., 1950	3,165,997,915	4,343	8,935	13,278	238,439
Nov., 1950	2,068,871,913	2,536	5,331	7,867	364,672
Dec., 1950	2,813,042,212	2,278	5,968	8,246	341,140
Jan., 1951	2,840,847,511	2,870	8,436	11,306	251,269
Feb., 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,531

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE AUGUST ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of units	Horse-power	Service	Builder
Canadian National	3	1,200	Road	General Motors Diesel, Ltd.
Central Vermont	1	1,000	Switch	Alco-G. E.
Canadian Pacific	18[1]	1,500	Passenger and freight	General Motors Diesel, Ltd.
	10[1]	1,600	Passenger and freight	Montreal Loco. Wks.
Chicago & Eastern Illinois	4[2]	1,500	General purpose	Electro-Motive
Erie	1B[3]	1,500	Freight	Electro-Motive
	3[3]	1,500	Road switch	Electro-Motive
	4[3]	1,000	Switch	Electro-Motive
	4[3]	1,600	Road switch	Baldwin-Lima-Hamilton
	2[3]	1,600	Road switch	Alco-G. E.
	1[3]	1,000	Switch	Alco-G. E.
Missouri Pacific	18[4]	2,250	Passenger	Electro-Motive
	55[4]	1,500	Road switch	Electro-Motive
	40A & B[4]	1,500	Road freight	Alco-G. E.
	13[4]	1,000	Switch	Baldwin-Lima-Hamilton
Ontario Northland	8[5]	1,600	Road switch	Montreal Loco. Wks.
Utah	3[6]	1,600	Road switch	Alco-G. E.

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Atchison, Topeka & Santa Fe	200	70-ton tank	
	150	70;ton gondola	Company shops
Canadian National	1,500	50-ton box	Canadian Car & Fdry.
	260	50-ton box	Eastern Car
	750	70-ton gondola	Eastern Car
	30	50-ton dump	Eastern Car
	5	70-ton hopper	Eastern Car
	10	30-ton stock	Eastern Car
	500	50-ton flat	National Steel Car
	750	70-ton hopper	National Steel Car
	500	50-ton refrig.	National Steel Car
	125	70-ton covered hopper	Canadian Car & Fdry.
Chicago & North Western	250[7]	70-ton covered hopper	Pullman-Standard
Chicago, Indianapolis & Louisville	250[8]	50-ton PS-1 box	Pullman-Standard
Delaware, Lackawanna & Western	100	70-ton covered hopper	American Car & Fdry.
Grand Trunk Western	250	40-ton box	American Car & Fdry.
	250	70-ton hopper	General American
Union Pacific	100[9]	Caboose	Company shops
Wabash	50[10]	70-ton gondola	Greenville Steel Car
	100[10]	70-ton covered hopper	Pullman-Standard

PASSENGER-CAR ORDERS

Road	No. of cars	Type of car	Builder
Canadian National	30	Baggage	National Steel Car

[1] Delivery of the 1,500-hp. units is to begin this month. Two of the 1,600-hp. units have already been delivered. This equipment will replace Selkirk-type steam locomotives used for heavy mountain work. Among the displaced units will be locomotive No. 5935, probably, the road says, the last steam locomotive to be acquired by the C. P., being the last of an order for six delivered in 1949.

[2] Estimated cost $600,000. Two units were delivered in August. Delivery of the other two expected this month.

[3] Delivery of the Electro-Motor, units expected in February and March; the Baldwin-Lima-Hamilton units in November of this year; the Alco-G. E. units also in November, and the one switching unit in March.

[4] Delivery expected to start in January and to be completed by August, 1952. 101 units are to be radio equipped. The new diesels will permit retirement of 164 steam locomotives, according to the road's statement.

[5] Approximate cost, $1,600,000. Delivery expected early this month.

[6] Estimated cost, $630,000. Delivery scheduled for December.

[7] To cost about $1,750,000. Delivery scheduled for the second quarter of 1952.

[8] Approximate cost, $1,400,000. Delivery scheduled for the third quarter of 1952.

[9] Estimated cost $1,520,000. Delivery expected in February 1952.

[10] Delivery expected in the second quarter of 1952.

NOTES:

Grand Trunk Western.—The Grand Trunk has purchased six lightweight streamline coaches from the Chesapeake & Ohio.

Union Pacific-Chicago & North Western.—These roads are reported to be inquiring for 23 passenger cars for use in their joint services.

group, spokesmen for the T. C. said this rolling stock and motive power is for use in this country and overseas, and limited quantities will be used for a "mobilization reserve."

Herman Lemp Receives Henderson Medal

THE Franklin Institute has awarded the George R. Henderson Medal to Herman Lemp, of Ridgewood, N. J., for his contributions to the development of the diesel-electric locomotive. Formal presentation of the award, a gold medal given for meritorious inventions or discoveries in the field of railway engineering, will take place on October 17 at special ceremonies in Franklin Hall, Philadelphia.

Mr. Lemp, a naturalized citizen of the United States, was born in Berne, Switzerland, in 1862 and was educated at the Gymnasium Burgdorf College and at Neuchatel Academy. He spent three years in the Fabrique de Telegraphes et Appareils Electriques Hipp Neuchatel, and later came to this country to work in the laboratories of Thomas Edison in Menlo Park, N. J., and New York. He was an electrical engineer with Schuyler Electric Company for six years and chief engineer of the Thomson Electrical Welding Company from 1889-1895.

He was for many years affiliated with the General Electric Company both in Massachusetts and in Erie, Pa., where he developed the electrical transmission for the diesel-electric locomotive. He later became chief engineer for the Erie Steam Shovel Company and then consulting engineer of the Locomotive Department of the Ingersoll Rand Company. From 1938 to 1940 he was engaged in railroad building for the New York World's Fair.

Shale Oil for Diesels Success

A FIVE-WEEK road test in which Denver & Rio Grande Western switching locomotive No. 100 operated on diesel fuel made from shale oil in the Bureau of Mines' oil-shale demonstration plant near Rifle, Colo., has been pronounced a complete success by E. A. Perlman, general manager of the road, and J. H. East, Jr., regional director of the bureau.

The shale oil product performed as well as standard diesel petroleum fuel normally used by railroads, Mr. Perlman and Mr. East said, and inspection of the engine after the test disclosed only normal wear and carbon deposition. A small amount of gum was found on the filters, but this can be eliminated in the refining stage, according to members of the bureau's refining staff at Rifle.

The experiment was made under a cooperative agreement between the Rio Grande and the bureau, with the former supplying a 1,000-hp. 12-cylindr diesel unit and the bureau providing 5,180 gal. of fuel oil. The first limited test of shale oil diesel fuel in a locomotive took place on September 1, 1950, when the Rio Grande's "Prospector" made a successful run from Salt Lake City to Denver. Further tests are under consideration.

Freight-Car Program Cut Expected

THE National Production Authority has announced that allotments of steel, copper and aluminum in the fourth quarter of this year will cut freight car production by as much as 10 per cent in the first three months of 1952.

On the basis of planned allotments to the railroad industry in the fourth quarter, there will be material sufficient for construction of 24,500 freight cars and 2,500 tank cars in the first quarter of 1952, the agency said. The announcement also said that a "very substantial cut" in the amount of maintenance, repair and operating supplies is "considered probable" in the first quarter of next year.

This announcement by N.P.A. followed a meeting with members of the agency's Railroad and Railroad Contract Car Builders Committees.

According to N.P.A., members of the Railroad Advisory Committee protested the tentative decision to allocate steel first for the car-building program and then to allot the remainder for MRO supplies. This committee asked that MRO be given first priority.

Acceptance of this change, N.P.A. said, would reduce the freight car program to about 10,000 cars a quarter.

The Contract Car Builders Committee was critical of this recommendation that MRO supplies be given top priority, N.P.A. said. They warned that such a move would

"demoralize" the building industry, and said the heavy cut in production would increase the cost per car by from $1,000 to $2,000.

The agency said both railroad and car builder representatives agreed on the need for 10,000 new freight cars a month, but N.P.A. maintained that demands for steel allotments in the fourth quarter already range "from 125 per cent to 600 per cent of anticipated supply."

Following this freight car announcement, N.P.A. issued a similar statement with respect to locomotives. These, too, will be cut back in the first quarter of 1952, and production is now estimated at 750 for the three-month period. In the fourth quarter of this year, 825 locomotives are scheduled for production.

SUPPLY TRADE NOTES

UNITED STATES STEEL COMPANY.—*Albert R. Pfeltz, Jr.*, assistant to the sales manager, New York district, United States Steel Company, has been appointed assistant sales manager in the Cincinnati district sales office.

◆

CANADIAN LOCOMOTIVE COMPANY.—The first units of the Consolidation Line locomotives to be produced at the Kingston, Ont., plant of the Canadian Locomotive Company were dedicated at ceremonies at Kingston on August 1. Upwards of $2,000,000 is to be spent in modernization and plant equipment to produce the Fairbanks-Morse opposed-piston diesel engines and assemble the completed locomotives. By the end of this year it is expected that the plant's capacity for diesel-electric locomotive production will be in excess of the 16 locomotives a day which were built when the plant was turning out steam power. The increased facilities at the Kingston plant are for the production of diesel switchers and industrial locomotives as well as road power. The units dedicated on August 1 are the Canadian prototype of the Consolidation, or C-Line locomotives, in which packaged units can be combined to produce 78 different locomotive combinations with one standard car body. The Consolidation line ranges from 1,600 to 9,600 hp. and are adapted to all classes of service.

◆

ALUMINUM COMPANY OF AMERICA.—A new aluminum smelting plant, said to be the first in history to use lignite (subbituminous coal) for fuel will be built by the Aluminum Company of America. Application has been filed to begin construction of the plant in the immediate future at one of several alternate locations approximately 60 miles south of Waco, Tex. Production of metal is expected to start in the early fall of 1952, with a capacity of 85,000 tons of aluminum annually.

◆

NIAGARA MACHINE & TOOL WORKS.—The Niagara Machine & Tool Works has moved its offices from the General Motors Building to 15484 James Couzens Highway, Buffalo.

The Rt. Hon. C. D. Howe, Canadian minister of trade and commerce and minister of defense production, to the left of Robert H. Morse, Jr., president both of the Canadian Locomotive Company and Fairbanks, Morse & Co., christening the first 3,200-hp. two-unit locomotive, the "City of Kingston," to leave the Kingston plant

LANDIS TOOL COMPANY. *J. S. Mourer* has been appointed manager of the new office of Landis at 4140 Brownsville Road, Pittsburgh 27. Mr. Mourer previously worked in the Chicago area.

◆

LINCOLN ENGINEERING COMPANY.—*John E. Renner* has been appoined general sales manager of Lincoln Engineering.

◆

ESSO STANDARD OIL COMPANY.—*E. W. Ball*, railroad sales engineer of Esso, has been appointed assistant manager of the railroad sales division of the company. Mr. Ball became associated with the company in 1942. Prior to that he had been supervisor of auxiliary equipment of the New Haven.

◆

AMERICAN CAR & FOUNDRY CO.—*William M. Hawkins*, formerly laboratory director for the American Car & Foundry Co., at Berwick, Pa., has been appointed senior research engineer at New York, in the research and development department.

◆

CUMMINS ENGINE COMPANY.—*Robert E. Huthsteiner* has been elected president of the Cummins Engine Company, Columbus, Ind. Mr. Huthsteiner succeeds *J. Irwin Miller* who has become chairman of the board.

◆

ELECTRO-MOTIVE DIVISION.—The Electro-Motive Division of General Motors Corporation has announced the following changes in sales, service and parts personnel: *C. L. Moss*, sales representative at Washington, D. C., as district sales manager at New York; *James B. Swindell*, sales representative at Chicago, as district sales manager there; *Warren A. Thomas*, manager of statistics and market analysis section in the sales department as sales manager, LaGrange factory branch; *Harold P. Gustafson*, sales engineer at LaGrange, as sales representative at New York; *Donald S. Fricke*, district engineer, New York region, as sales representative at Washington; *Floyd E. von Ohlen*, sales engineer at LaGrange, as sales representative, Chicago region; *Norbert A. Minor*, parts representative, Chicago region, as Chicago sales representative; *Charles F. Lincoln, Jr.*, manager of the production application section of the sales department, as assistant general parts manager; *Kenneth J. Wolf*, of the product application section as Mr. Lincoln's successor; and *John F. Greenip*, service engineer at St. Louis, as parts representative for that region.

CUMMINS-CHICAGO CORPORATION. — *Mitchell A. Kapland*, vice-president, has been placed in charge of sales activities of all four divisions of Cummins-Chicago, including the Portable Tool division. *R. E. Mitchell* has been been appointed field sales manager of the Portable Tool division.

◆

DEARBORN CHEMICAL COMPANY.—*C. S. White*, who has been appointed manager of the eastern division of the Dearborn Chemical Company, at New York, to replace the late Herbert J. Cornell, former

C. S. White

vice-president, eastern division, whose death is reported on another page in this issue. Mr. White was formerly manager of the eastern division water treatment department.

◆

BUDD COMPANY.—The following personnel changes have been made in the railway sales division of the Budd Company: *Thomas R. Wagner*, head of the New York office, has been appointed regional sales manager at Chicago, succeeding *John E. Wright*, resigned. *Robert A. Sherman*, formerly in charge of the St. Louis office will succeed Mr. Wagner at New York. The St. Louis office will be closed September 30 and its functions will be transferred to the Chicago office. *Percy R. Keller*, operating from general headquarters in Philadelphia, has assumed the duties of *James M. Plaskitt*, who has resigned as head of railway sales activities in Washington, D. C.

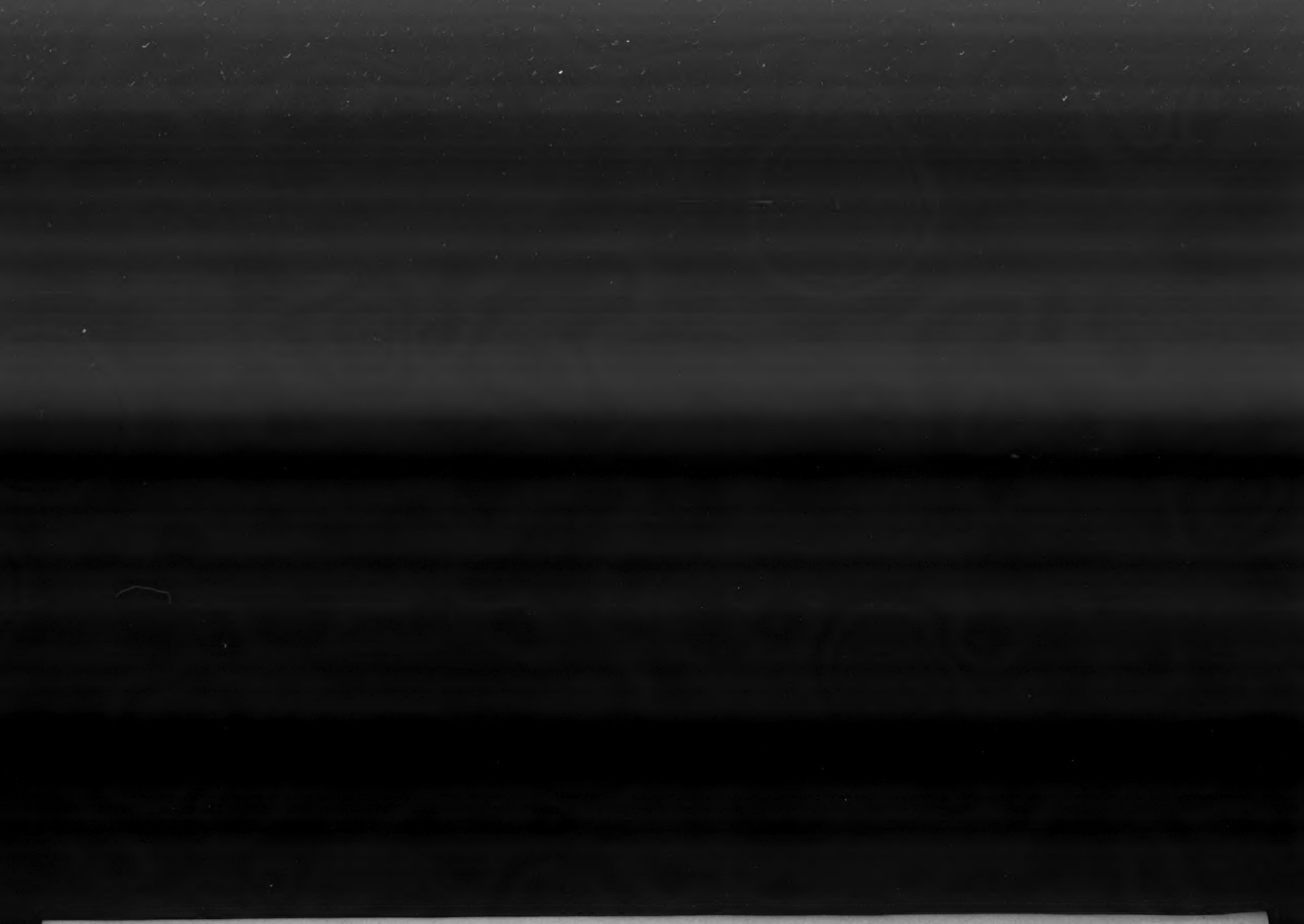
◆

WORTHINGTON PUMP & MACHINERY CORP. —*A. H. Borchardt* has been elected a vice-president of the Worthington Pump & Machinery Corp., with overall responsibility for sale of the corporation's entire line of pumping equipment, including centrifugal, reciprocating and vertical turbine pumps.

◆

ELECTRIC STORAGE BATTERY COMPANY.—The Electric Storage Battery Company has moved its general offices from its plant at 19th street and Allegheny avenue to 15th and Chestnut streets, Philadelphia. Offices concerned with engineering and manufac-

(*Continued on page 100*)



Because General Motors Diesel locomotives are designed, built and serviced by a single organization, responsibility for all phases of locomotive performance is centralized in a single source.

That accounts for a nationwide staff of field service engineers—for factory instruction of railroad operating and maintenance supervision —for strategically located factory branches and convenient parts depots—one source—one responsibility for everything—for every locomotive we've built!

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS LA GRANGE, ILL.

Home of the Diesel Locomotive

In Canada: GENERAL MOTORS DIESEL, LTD., London, Ont.

turing operations will be moved from 19th street and Allegheny avenue to the company's other Philadelphia plant, at Rising Sun and Adams avenues, when a $5,000,000 building program is completed there.

◆

CHICAGO MALLEABLE CASTINGS COMPANY.—*L. T. Hartwig* has been elected vice-president of the Chicago Malleable Castings Company.

◆

SUNROC COMPANY.—The Sunroc Company has appointed two new distributors for its electric water cooling and purifying equipment—the *Johnson Electrical Supply Company*, Cincinnati, in the Cincinnati area, and the *Crane Company*, Pittsburgh, in the Pittsburgh area.

◆

UNION ASBESTOS & RUBBER CO.—*W. H. Mowers, Jr.*, has been appointed eastern sales representative for the Union Asbestos

W. H. Mowers, Jr.

& Rubber Co., with headquarters at New York. Mr. Mowers previously served as administrative assistant in the railroad sales department at Chicago.

◆

WESTINGHOUSE AIR BRAKE COMPANY; UNION SWITCH & SIGNAL CO.—The merger of the Westinghouse Air Brake Company and its two subsidiaries, the Union Switch & Signal Co., Swissvale, Pa., and the Westinghouse Pacific Coast Air Brake Company, Emeryville, Cal., has been approved by stockholders.

◆

CHICAGO STEEL SERVICE COMPANY.—*Walter H. Creber, Jr.*, has been appointed sales manager of Chicago Steel Service, with headquarters at the company's new general offices and warehouse on Kildare avenue and 45th street, Chicago.

◆

CHICAGO STEEL SERVICE COMPANY.—The Chicago Steel Service Company has moved to new general offices and warehouse on Kildare avenue at 45th street, Chicago.

◆

WATSON-STILLMAN COMPANY. — *H. L. Henry*, formerly western New York state representative for the Watson-Stillman Company, Roselle, N. J., has been ap-

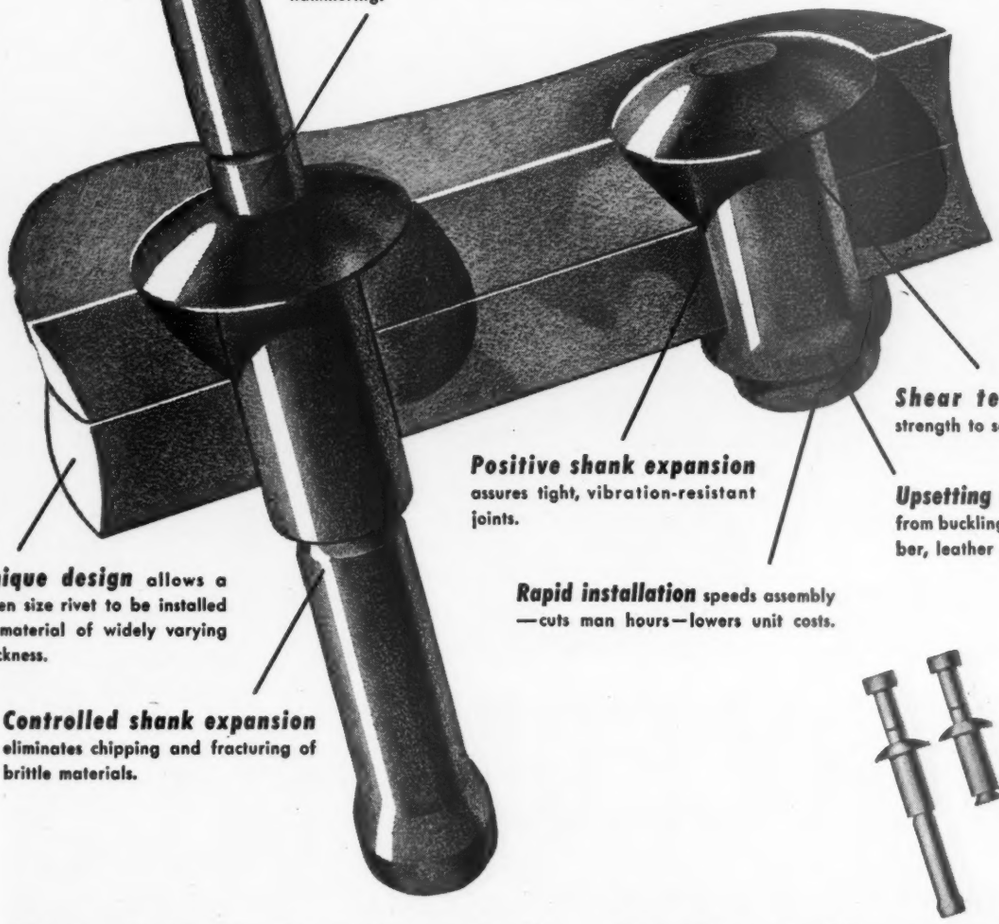
Here's why

CHERRY RIVETS

make the hard jobs easy

Installed **by one man from one side of the job.**

A pulling action **does the work —no twisting, no exploding, no hammering.**



Shear tests **show comparable strength to solid rivets.**

Positive shank expansion **assures tight, vibration-resistant joints.**

Upsetting method **prevents shank from buckling in soft materials like rubber, leather or fabric.**

Unique design **allows a given size rivet to be installed in material of widely varying thickness.**

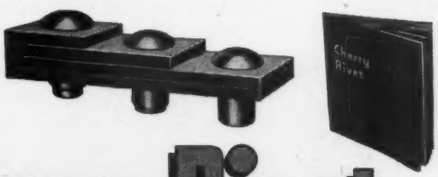
Rapid installation **speeds assembly —cuts man hours—lowers unit costs.**

Controlled shank expansion **eliminates chipping and fracturing of brittle materials.**

For you, the particular value of Cherry Rivets may be the simplicity of installation. Or you may need the strength of Cherry Rivets and their vibration-resistance. But if you haven't met their money-saving advantages, take a moment today to ask for full information covering your applications.

Once you've realized the potential values in Cherry Rivets, your engineers and Cherry's can cooperate in determining the savings for your business.

Standard Cherry Rivets are available in five diameters, from 1/8" to 9/32". Special sizes manufactured on order.



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CHERRY RIVETS ARE APPROVED BY U.S. NAVY, U.S. AIR FORCE AND CIVIL AERONAUTICS AUTHORITY. CHERRY RIVETS ARE PATENTED.

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Please send me further information describing Cherry Rivets; no obligation, of course. ☐ bulletin ☐ sample rivets

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City_____ Zone_____ State_____

pointed divisional sales representative for northern Ohio, with headquarters in Akron, Ohio. The *Don W. Patterson Company,* 2016 Rand building, Buffalo, N. Y., has been appointed exclusive sales representative in western New York.

◆

UNION CARBIDE & CARBON CORP.—*Lem Adams,* vice-President of *Oxweld Railroad Service Company,* a division of Union Carbide and Carbon Corporation, has retired from active service.

Mr. Adams, a graduate of Texas Agricultural and Mechanical College, joined Oxweld as chief engineer in 1933. He started his railroad career in 1908 on the Union Pacific where he was chief engineer at the time he resigned to join Oxweld.

◆

IRVINGTON SUBWAY GRATING COMPANY.—The Irvington Subway Grating Company, of Long Island City, N. Y., and Oakland, Calif., has appointed *Guilford S. Turner, Inc.,* of Chicago, national sales representative for freight cars and locomotives.

◆

VANADIUM CORPORATION OF AMERICA.—*T. W. Merrill* has been appointed chief metallurgical engineer of the Vanadium Corporation and has been transferred from the company's plant at Bridgeville, Pa., to headquarters in New York. Mr. Merrill, a graduate of Yale School of Engineering

T. W. Merrill

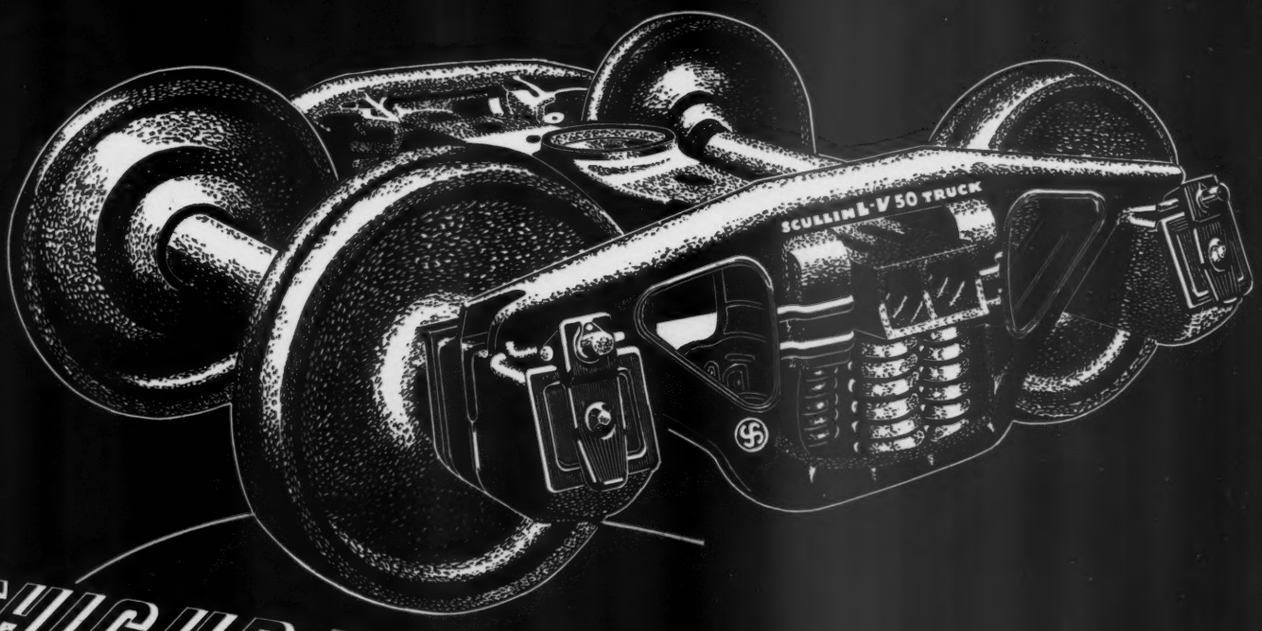
in 1936 with a B.E. degree, began his career with the United States Steel Corporation as a metallurgical observer at the Duquesne Works. In 1939 he was transferred to the research laboratory at Kearny, N. J. Two years later he became metallurgist in the employ of Vanadium at Bridgeville and in 1949 was appointed metallurgical engineer.

◆

GRAYBAR ELECTRIC COMPANY.—*W. E. Guy* has been appointed Chicago district manager of the Graybar Electric Company to succeed *G. J. Cossmann,* who has retired after more than 51 years of service.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—*Hendley Blackmon* has been named manager of engineering association activities for the Westinghouse Electric Corporation. He will work with Westinghouse engineers in the preparation of papers to be pre-



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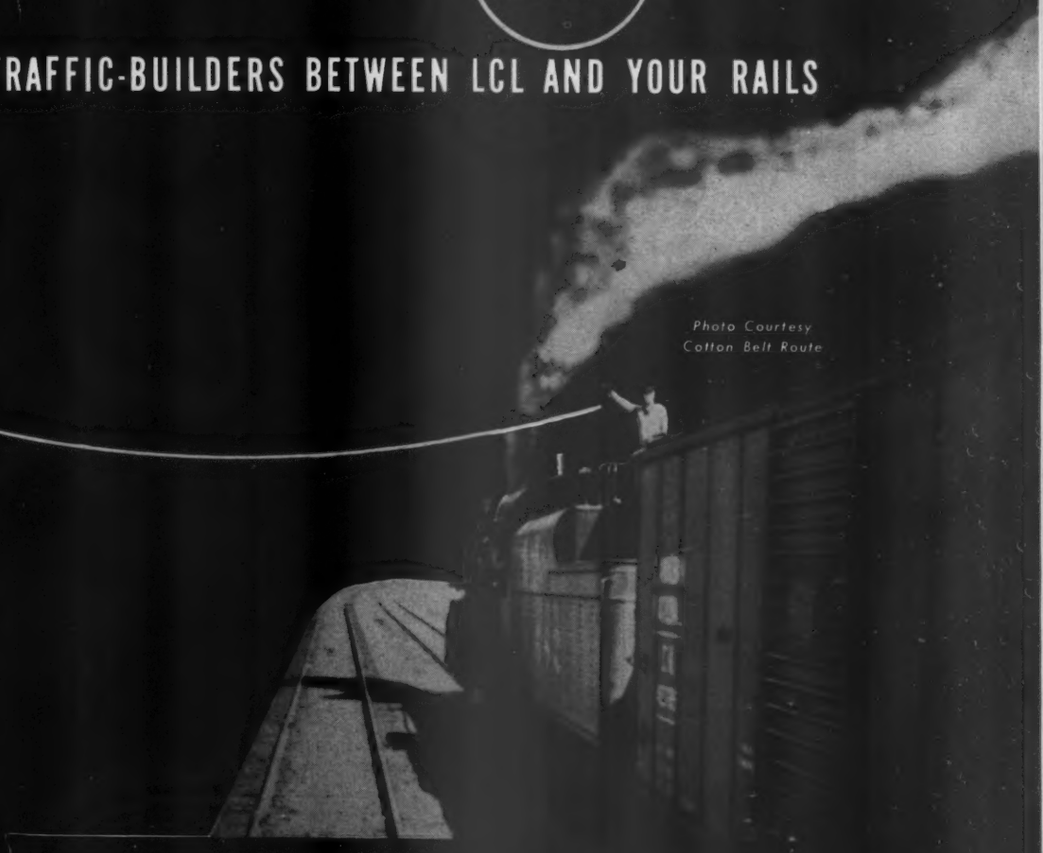
LATERAL VERTICAL
CUSHIONED MOTION

THE SMOOTHEST TRAFFIC-BUILDERS BETWEEN LCL AND YOUR RAILS



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sented before engineering association meetings. Mr. Blackmon, who has served as assistant manager of the activity since 1949, succeeds *Frank Thornton, Jr.*, who recently retired.

◆

ALLIED STEEL CASTINGS COMPANY.—*J. T. Llewellyn, II*, and *L. J. Wise* have been elected respectively, president and vice-president of the Allied Steel Castings Company, Chicago and L. F. Hartwig will assume the title of assistant to the president.

◆

HUNT-SPILLER MANUFACTURING CORPORATION.—*Richard P. Carroll* has been appointed production control manager for Hunt Spiller at Boston, Mass., and will continue in charge of cost and materials controls.

◆

NATIONAL MALLEABLE & STEEL CASTINGS CO.—*John P. Kelleher* has been appointed assistant sales manager of the Chicago works of National Malleable & Steel Castings Co.

Mr. Kelleher became associated with the company at Chicago in 1941 in its Cost and Accounting department at Chicago from 1941 until 1943, when he first entered sales work. He has been in the Chicago sales department since 1943.

National Malleable will build a new physical testing laboratory for railway engineering development work in Cleveland, according to the company's president, Cleve H. Pomeroy. The engineering laboratory will cost $750,000. The buildings and test tracks will occupy about five acres of land. Research on car couplers will be continued and expanded with the new facilities. Among other railroad equipment items which will be studied, tested and developed at the laboratory are rubber and friction-type draft gears for freight and

J. P. Kelleher

passenger cars and motive power equipment, freight car trucks, journal boxes and journal box lids, as well as similar devices for the mine and industrial fields. *Kenneth L. Selby*, chief engineer of National's railway division, will direct the activities of the laboratory.

The main laboratory building will have a 1,000,000-lb. static test machine, a 27,000-lb. drop test machine, fatigue and angling machines and much other physical laboratory equipment. The test tracks, which will be about 1,400 ft. long, will extend partly

CLOSE-UP of B&D No. 6 Universal Valve and Tool Grinder shows clean, gadget-free design—conveniently placed controls—clear visibility of workpiece.

THESE 5 EXCLUSIVE FEATURES on the B&D No. 6 Grinder give you faster, more accurate valve grinding. They produce better finishes—free from chatter marks. They eliminate costly regrinding or scrapping of valves.

This B&D No. 6 Grinder

. . . refaces diesel valves up to 5¼" head diameter. Also handles small gasoline engine valves and a host of other jobs. The work-head chuck stems from ¼" to 1¼" and rotates for 0° to 90° grinding. It's ideal for grinding tappets, rocker arms, valve stems. And you can quickly convert it for tool grinding. Let your nearby B&D Distributor show you the Black & Decker No. 6 Universal Valve and Tool Grinder's advanced features. Call him today—or write for detailed booklet to: The Black & Decker Mfg. Co., 665 Pennsylvania Ave., Towson 4, Maryland.

1. **HYPOID GEAR DRIVE** on work-head spindle insures extremely smooth operation and mirror-finish valve faces.
2. **AIR-OPERATED WORK-HEAD CHUCK** gives speedy opening and closing of valve stem collets, accurate centering of every valve.
3. **PRECISION-GROUND FEED SCREWS** are bearing mounted for fast, smooth travel of wheel-head and work-head. Wheel-head feed screw is calibrated in thousandths for close tolerance grinding.
4. **SEPARATE UNIVERSAL MOTOR** drives work-head at controlled speeds to produce best grinding conditions for either large or small valve heads. Automatic motor cut-off controlled by table travel.
5. **SEPARATE ¼ HP CONSTANT SPEED MOTOR** assures abundant power and proper speed for 6" grinding wheels or cup wheels.

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B&D Black & Decker

PORTABLE ELECTRIC TOOLS

inside the building so that railroad cars can be brought under cover for the installation of new devices. The track inspection pit will also be under cover. Outside the building both straight and curved stretches of track will be laid. The straight portions will allow car speeds up to 22 m.p.h.

A feature of the installation will be two specially built railroad cars, equipped with a large amount of electronic equipment and instruments of special design for testing car attachments. The test tracks will connect with outside railroad lines. The cars will also be used to display and demonstrate full size models of devices to the railroad men.

It is intended to expand new product development engineering into other lines such as automotive, truck, etc.

◆

IRVINGTON VARNISH & INSULATOR CO.—The *Franklin Railway Supply Company*, 60 East 42nd Street, New York, has been appointed exclusive representatives in the railroad field for the Irvington Varnish & Insulator Co., Irvington, N. J.

◆

NATIONAL BRAKE COMPANY—The *St. Louis Railway Supply Company*, 2114 North 2nd Street, St. Louis 6, has been appointed representative of National Brake in the railroad district centered in St. Louis. *Frank E. Ross, Jr.*, and *Robert M. Close* are in charge of this district.

F. E. Ross, Jr.

R. M. Close

More than 37 Railroads*

now using the new SAFE-N-EZY Filter WASHER-OILER TO PIN DOWN MAINTENANCE COSTS AT KEY SERVICE POINTS

...ama Great Southern R.R. Co.	Kansas City Southern Ry.
...ntic Coast Line (4)	Louisville & Nashville R.R.
...more & Ohio Rd. (9)	Minneapolis, St. Paul & S. Ste Marie
...mer & Lake Erie	Missouri-Kansas-Texas Lines
...tral of Georgia (2)	Missouri Pacific R.R. (2)
...rleston & Western Carolina	Nashville, Chattanooga & St. Louis
...cago & North Western Ry. (4)	New York Central R.R.
...cago, Burlington & Quincy Rd. (5)	New York, New Haven & Hartford Rd.
...cago, St. Paul, Minneapolis & Omaha Ry.	New Orleans & North Eastern
...cinnati, New Orleans & Texas Pacific	Ontario Northland Ry.
...cinnati Union Terminal	Pennsylvania Rd. (4)
...monough & Black Lick R.R.	St. Louis-San Francisco Ry. (5)
...aware & Hudson	St. Louis Southwestern Ry.
...rida East Coast Ry.	Seaboard Air Line
...t Worth & Denver City	Texas & Pacific Ry.
...at Northern (2)	Union Pacific Rd.
...ois Central Rd.	Wabash Rd.
	Washington Terminal (2)
	Western Pacific
	Commonwealth Railways (Foreign)

More and more railroads are installing a SAFE-N-EZY Air Filter WASHER-OILER at every key service point — your proof of its acceptance and value as a faster, more efficient, less expensive method of air filter maintenance. So why not get all the details on this amazing new piece of equipment now and join this growing list of progressive railroads?

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through tremendous savings on filter maintenance

Here's Why:

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Railway Supplies — Specialty Appliances, Tools and Parts for Locomotives and cars including: SELF-SEALING QD COUPLINGS • SAFE-N-EZY VALVE SPRING DEPRESSORS • BINGHAM CRANKSHAFT SLEEVING PROCESS • SAFE-N-EZY BELT CUTTERS • P-M METALLIC PACKING • SAFE-N-EZY FILTER WASHER-OILER • PAXMITE IRON CASTINGS • SAFE-N-EZY PRESSURE DETECTORS • WILLIAMS GRIP TRACTION MOTOR TERMINAL BLOCKS.

SPRING PACKING CORPORATION.—*W. H. Russell*, vice-president of Spring Packing Corporation, at Chicago, has been appointed vice-president in charge of railroad sales. Mr. Russell, who was born in Clinton, Ill., July 7, 1912, is a graduate of the University of Illinois (1934). He served in the traffic department of the Illinois Central until 1936, when he became a

W. H. Russell

sales representative for the American Locomotive Company at Cleveland. He was appointed acting district sales manager in 1942 and two years later became Southwestern district manager, for the Baldwin Locomotive Works at St. Louis, In 1948 he joined the Spring Packing Corporation as vice-president.

◆

P. A. MCGEE has opened an office at 30 Broad street, New York 4, as a consulting transportation engineer, specializing in economic, operating and maintenance problems related to railroad motive power. Mr. McGee, who until recently was assistant manager, Eastern Region, of the Electro-Motive Division, General Motors Corporation, at New York, was born in Ardee County South, Ireland, on March 12, 1892. He attended Clongoes Wood College, Ireland, and the London School of Science and Technology and began his career in 1909 as a student engineer, street railways, London County Council. He took the test course of the General Electric Company here in America from 1910 to 1911, and then became electrification inspector on the New York, New Haven & Hartford. From 1914 to 1919 he was resident engineer on suburban electrification at Melbourne, Australia, for Merz & McLellan, consulting engineers. He became general engineer on railway electrification for the Westinghouse Electric & Manufacturing Company (now the Westinghouse Electric Corporation) in 1920; assistant electrical engineer for the Reading in 1931, and in 1937 assistant manager, Eastern Region, Electro-Motive Division. Mr. McGee is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, and the Franklin Institute.

◆

DEVILBISS COMPANY.—*W. C. Spruce*, direct factory representative of the DeVilbiss Company's spray painting and finishing equipment division, has been appointed southwest district manager. Mr. Spruce will

ESSO COBLAX

"Tailor-made" to railroad specifications

The Sign of QUALITY — Esso — The Symbol of SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. — Memphis, Tenn. — New Orleans, La.

ESSO COBLAX LUBRICANTS

have been specifically developed to provide highly dependable gear lubrication for traction motor drives on electric and diesel-electric locomotives; gas electric and multiple-unit cars; and many other locomotive and car lubrication requirements. Esso COBLAX is availabe in a wide range from fluid oils to semi-solid products... "tailor-made" for railroad applications.

BACKED BY CONSTANT RESEARCH

—keeping pace with latest engine design and developments. Esso Railroad Products are constantly being tested and improved.

BACKED BY CONSTANT FOLLOW-UP

—on-the-job check-ups by Esso Sales Engineers assure dependable performance of Esso Railroad fuels and lubricants! Be sure to call on ESSO for any fuel or lubricating problem.

continue to maintain offices at the DeVilbiss Company's branch, 1515 Dragon St., Dallas, Tex., and will supervise the company's sales activities in the newly created southwest district which includes Texas, Louisiana, Mississippi, Arkansas, Oklahoma, New Mexico, a section of western Tennessee and northwestern Alabama.

◆

WALL COLMONOY CORPORATION.—*Henry L. Howard* has been appointed manager of a new branch office at 5815 Clinton Drive, Houston 1.

◆

IRVINGTON VARNISH AND INSULATING COMPANY—*E. A. Freiburger*, formerly sales service manager, has been named general sales manager of the Coating Division of Irvington Varnish. Mr. Freiburger will be in charge of all sales activities for the Coating Division, including market research and sales promotion with the exception of cable insulation sales. *Jean H. Rooney* has been appointed to sales service manager, succeeding Mr. Freiburger, and *James D. Smith* has been appointed varnish sales manager.

◆

HELI-COIL CORPORATION.—The Heli-Coil Corporation, Long Island City, N. Y., has moved to a new plant in Danbury, Conn.

◆

WORTHINGTON PUMP & MACHINERY CORP. —*V. de P. Gerbereux* has been appointed manager of the Centrifugal Pump Sales division of Worthington, succeeding *A. H. Borchardt* who has recently been elected vice-president in charge of centrifugal, reciprocating and vertical turbine pump sales.

◆

PITTSBURGH SCREW & BOLT CORP.—*William N. Hoelzel*, assistant manager railroad sales of the Gary Screw and Bolt division of Pittsburgh Screw & Bolt, has been appointed manager railroad sales. John C. Jewett succeeds Mr. Hoelzel as assistant manager railroad sales.

Obituary

DAVID J. JONES, executive sales representative of the Vapor Heating Corporation, Chicago, died on August 14.

◆

ALFRED G. YORK, a director and vice-president of the Watson-Stillman Company, Roselle, N. J., died on July 22, after a prolonged illness.

◆

ARTHUR F. PITKIN, retired engineer for the American Locomotive Company died on July 9 in his home at Northport, Long Island, N. Y. Mr. Pitkin was 69 years old.

◆

CARL W. BENZ, executive vice-president of the International Railway Car & Equipment Manufacturing Co., died on July 15, after a brief illness.

◆

HERBERT J. CORNELL, 61, vice-president of the Dearborn Chemical Company, eastern division, of New York, died on July 13, in the White Plains, N. Y., Hospital.

◆

HARRY S. C. FOLK, formerly eastern railroad sales manager for the Automatic Transportation Company, died on July 18.

MOTOR WHEEL Deep Flange JOURNAL BOX LIDS

1. Hinge-pin supported by ¾" lid bearings. Worn holes and hinge-pin scoring eliminated.
2. Stops hold straight hinge-pin in position under spring pressure. NO TOOLS NEEDED TO INSERT OR SECURE HINGE-PIN.
3. Keeper-pin holds assembly during storage. After hinge-pin is inserted, hand pressure permits removal of keeper-pin WITHOUT USE OF TOOLS.
4. Coil spring and roller assembly, held snugly by sheared ears, lets lid open and close easily without wear on journal box lug.
5. Oil-tight center construction permits full articulation up, down, left and right to insure a tight fit.
6. Full pressed steel construction, 3/16" in housing and 5/32" in cover.
7. Opens 120° for easy access to journal.
8. Extended housing arm eliminates opening and closing strain on articulating point.

Give You 8 Superior Features plus Added Protection

NO TOOLS NEEDED

Neither the standard flange Motor Wheel Journal Box Lid illustrated above nor the Deep Flange model requires the use of tools to attach or detach.

The Deep Flange provides added protection from wind currents carrying foreign matter and moisture so harmful to efficient lubrication. Laboratory and field tests, plus the experience of thousands of lids in use, have proven the merits of the Deep Flange design.

NATIONAL RAILWAY SALES REPRESENTATIVE

T-Z RAILWAY EQUIPMENT CO.

8 S. Michigan Ave. Chicago 3, Ill.

MOTOR WHEEL CORPORATION

LANSING 3, MICHIGAN, U.S.A.

PERSONAL MENTION

General

O. R. PENDY, master mechanic of the New York, Chicago & St. Louis at Conneaut, Ohio, has been appointed chief mechanical officer at Cleveland. Mr. Pendy received his railway mechanical engineering degree from Pennsylvania State College

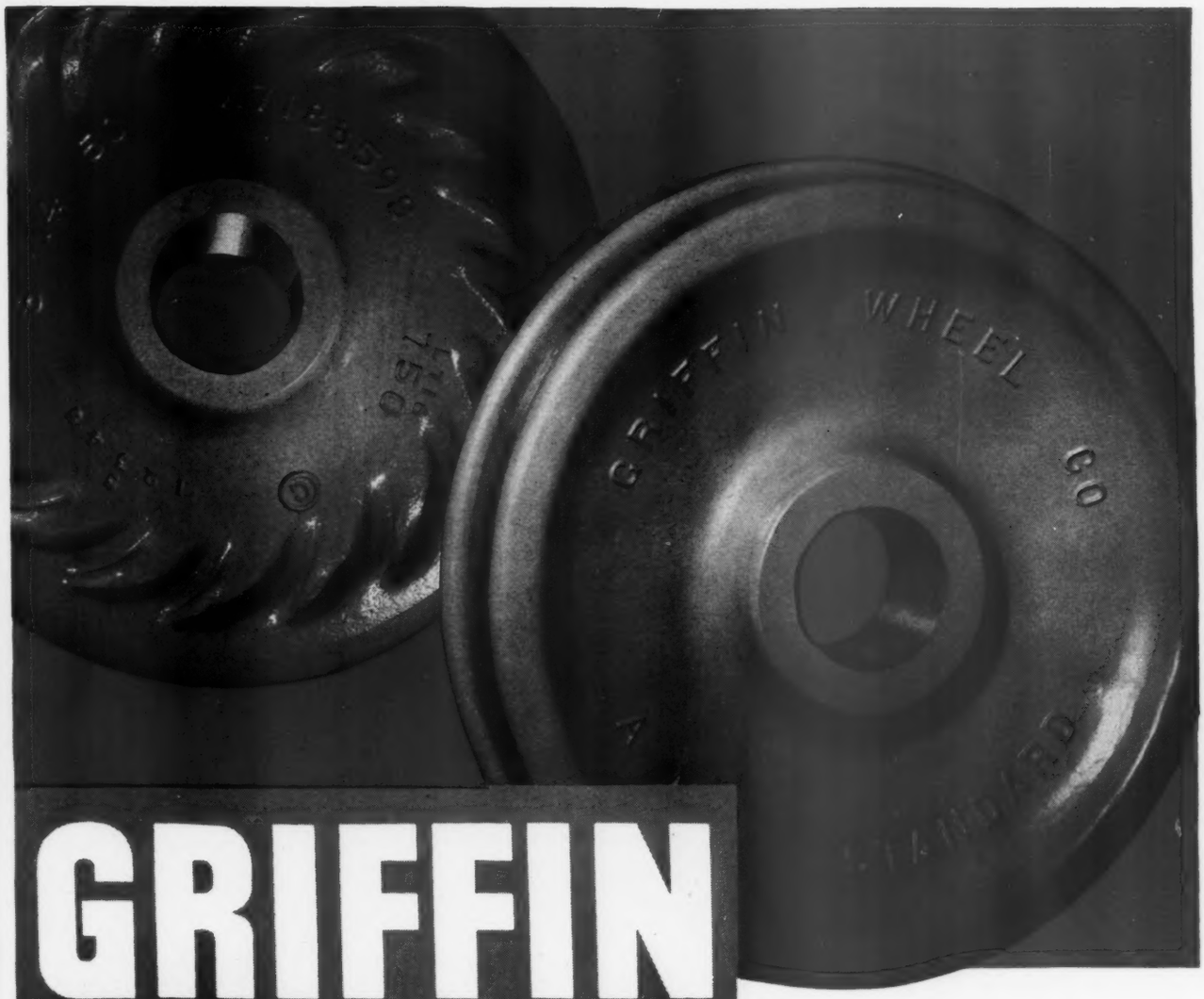
O. R. Pendy

in 1924 and joined the Nickel Plate that same year as special apprentice at Conneaut. He served as assistant to chief mechanical officer at Cleveland from 1945 to October 1, 1948, when he returned to Conneaut as master mechanic.

EVERETT H. WESTON, who was recently promoted to assistant chief mechanical engineer of the Chicago & North Western at Chicago, was born in that city July 17, 1916, and received a mechanical engineering degree from Northwestern University in 1938. Starting his career in 1939 as

Everett H. Weston

tracer on the North Western, Mr. Weston served successively as draftsman, design engineer and lead draftsman, car and locomotive, until his promotion to mechanical engineer in 1947. It was from that post that he was recently promoted.



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Chilled car wheels are **SAFE**

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MEMBER COMPANIES HAVE A RECORD
BY OTHER TYPES OF WHEELS.

"There is no safer wheel than the Chilled Car Wheel"

TACOMA • LOS ANGELES • SALT LAKE CITY • DENVER • ST. PAUL • KANSAS CITY
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THE WORLD'S LARGEST MANUFACTURER OF CHILLED CAR WHEELS

Member ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

N. L. McCracken, master mechanic of the Southern Pacific at Los Angeles, has been appointed assistant general superintendent motive power of the Pacific Electric.

Troy H. Bickerstaff has been appointed general supervisor of air brakes on the Atchison, Topeka & Santa Fe at Topeka, Kan.

H. R. Martin, assistant master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis at Indianapolis has been appointed special assistant to manager, equipment, of the system at New York, with duties to be assigned.

C. L. Tuttle, mechanical engineer of the Bessemer & Lake Erie at Greenville, Pa., has retired after 42 years of service with the road. Mr. Tuttle was born at Avon, N. Y., on August 1, 1881, and received his B.S. in M.E. degree from the University of Michigan in 1907. He entered railroad service during the summer of 1901 as an apprentice with the Erie and in 1907 became special apprentice for that road. He joined the B.&L.E. in 1908 as a draftsman and 10 years later became mechanical engineer.

Blair Leverett Thompson, superintendent of motive power and car equipment of the Manitoba division of the Canadian National at Winnipeg, Man., has been appointed general superintendent of motive power and car equipment of the Atlantic region at Moncton, N. B. Mr. Thompson was born on July 20, 1906, at Moncton, where he began his career with the C. N. as a telegraph messenger in November

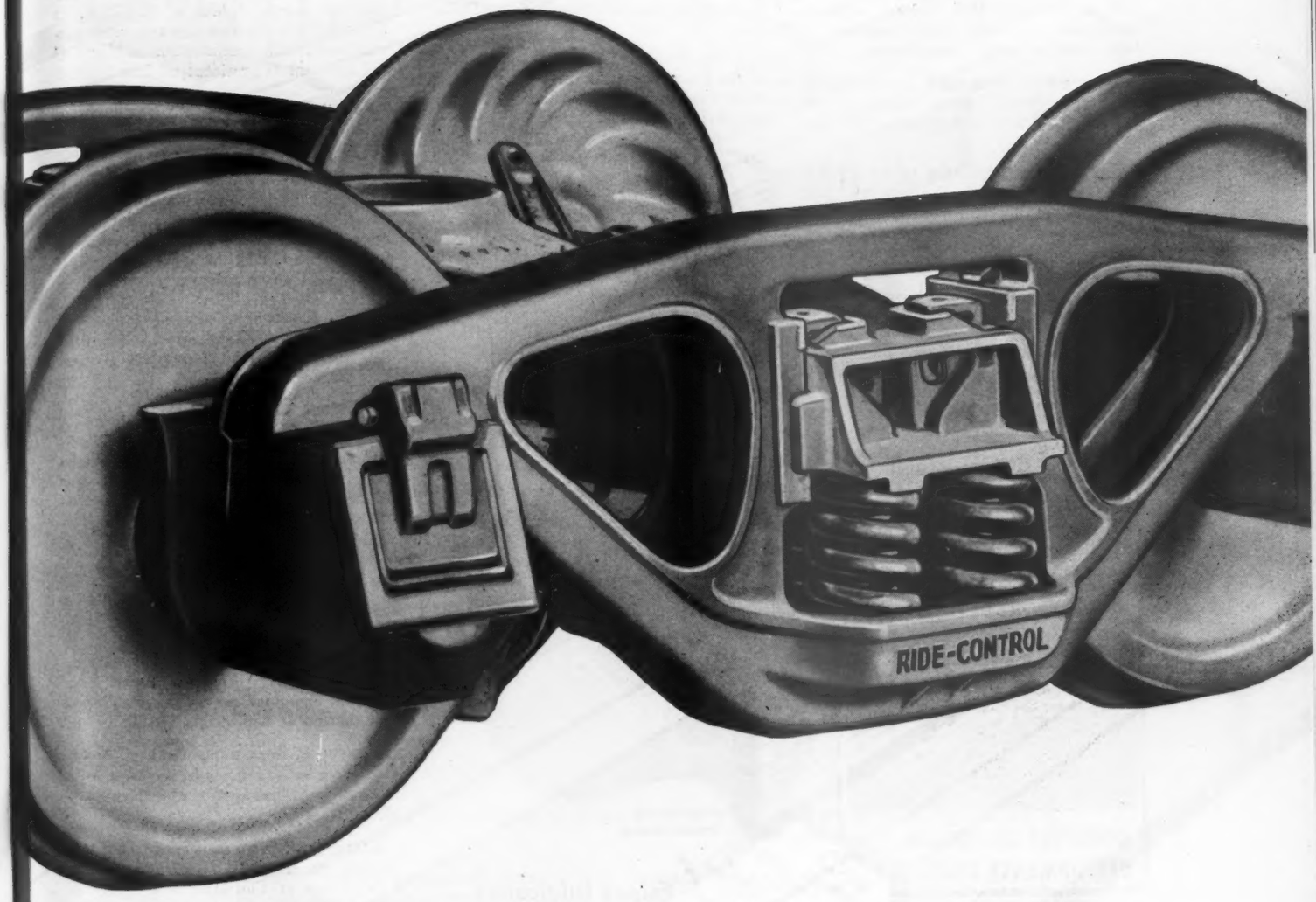
Blair L. Thompson

1923. He subsequently served as machinist apprentice, draftsman, mechanical inspector and assistant locomotive foreman. He was appointed mechanical inspector at Montreal in 1943; night superintendent at the Point St. Charles shops at Montreal on July 1, 1945; superintendent locomotive shops in April, 1946, and superintendent of motive power and car equipment of the Manitoba district at Winnipeg in 1949.

George Charles Hoey has been appointed mechanical engineer of the Bessemer & Lake Erie at Greenville, Pa. Mr.

G. C. Hoey

Hoey was born on April 4, 1894, at Richmond, Ind., and attended Purdue University (B.S. in Railway M.E., 1916). He entered railroad service on July 1, 1916, with the Santa Fe at Argentine, Kan., as special machinist apprentice, which position he held until May 1918, when he joined the 60th Railway Engineers, United States Army. In September 1919 Mr. Hoey returned to his former position with the Santa Fe and subsequently served as machinist, motive power inspector, apprentice instructor and roundhouse foreman. From July to December 1921 he was tool designer at the Indiana Tool Company, Richmond,



MORE USERS BUY MORE A·S·F RIDE-CONTROL®

TRUCKS THAN ALL OTHER TRUCKS COMBINED

...BECAUSE RIDE-CONTROL IS SMOOTH-RIDING,

LONG-LASTING—CUTS OPERATING COSTS!

AMERICAN STEEL FOUNDRIES

Mint Mark of ◯ Fine Products

Ind. Mr. Hoey joined the B. & L. E. at Greenville in January 1922 as draftsman and in February 1946 became assistant mechanical engineer, which position he held until his recent appointment.

FREDERICK A. BALDINGER, superintendent of motive power, Eastern region, of the Baltimore & Ohio, at Baltimore, Md., has retired.

GUY F. WILES, assistant to the general superintendent of motive power and equipment of the Baltimore & Ohio, has been appointed superintendent of motive power, Eastern region, with headquarters at Baltimore.

H. M. EPPS, night foreman of the Texas & Pacific at Shreveport, La., has been appointed mechanical inspector at Dallas, Tex.

E. A. SWEELEY, assistant to president of the Fruit Growers Express, the Western Fruit Express and the Burlington Refrigerator Express, at Washington, D. C., retired on July 1, after more than 49 years of railroad and refrigerator car line service. Mr. Sweeley's railroad service began with the New York Central in 1902, and he subsequently served in an official capacity with a number of roads, including the Atlantic Coast Line and the Seaboard Air Line. He was a member of the Railroad Adjustment Board under the U. S. Railroad Administration (1918-1920), and became mechanical superintendent of F. G. E. in May 1920. Mr. Sweeley was appointed general mechanical superintendent in May 1947 and assistant to president on July 1, 1950.

FRANK T. MCCLURE, general supervisor of air brakes of the Atchison, Topeka & Santa Fe at Topeka, Kans., has retired after 52 years of service.

JOHN E. KLOSS, supervisor of diesel and motor equipment of the New York, Chicago & St. Louis at Cleveland, has been appointed assistant to chief mechanical officer, with headquarters at Cleveland.

P. E. ENGELBACH, equipment inspector of the Bessemer & Lake Erie at Greenville, Pa., has been appointed assistant mechanical engineer.

Diesel

S. A. JONES has been appointed to the newly created position of district inspector of diesel equipment of the Canadian Pacific at Calgary, Alta. Mr. Jones was previously diesel and gas car maintainer at Winnipeg, Man.

Master Mechanics and Road Foremen

J. H. WEBB, assistant master mechanic of the Texas & Pacific at Ft. Worth, Tex., has been appointed master mechanic, with headquarters at Big Spring, Tex.

JOSEPH W. WALSH has been appointed road foreman of engines of the New York Central, with headquarters at Kankakee, Ill.

RALPH J. HUGHES, assistant to chief mechanical officer of the New York, Chicago & St. Louis at Cleveland, has been appointed master mechanic at Conneaut, Ohio.

H. L. MCDERMOTT, general foreman of the Texas & Pacific at Mineola, Tex., has been appointed assistant master mechanic at Big Spring, Tex.

R. L. SMITH, assistant master mechanic on the Southern Pacific at Los Angeles, has been appointed master mechanic at Los Angeles.

J. H. JUDD, assistant master mechanic of the Texas & Pacific as Big Spring, Tex., has been appointed assistant master mechanic at Ft. Worth, Tex.

J. W. RONAN has been appointed assistant master mechanic on the Southern Pacific at Los Angeles.

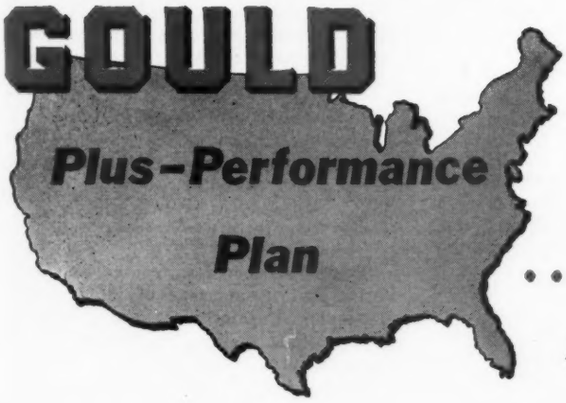
Car

T. S. CHEADLE, chief car inspector of the Richmond, Fredericksburg & Potomac at Richmond, Va., has retired after 51 years of railroad service.

Shop and Enginehouse

C. C. ODOM, enginehouse boiler foreman of the Texas & Pacific at Ft. Worth, Tex., has been appointed enginehouse foreman at Marshall, Tex.

GOULD



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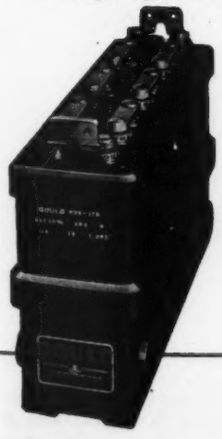
LENGTHEN BATTERY SERVICE!

Keeping of accurate records is vital to the conservation and extension of essential battery power. The GOULD PLUS-PERFORMANCE PLAN makes the keeping of battery records easy by providing you with full information on how to test your batteries, and charts and forms for recording test data.

This timely plan puts at your disposal a complete system of manuals, articles, specifications, bulletins, charts, graphs and forms explaining and illustrating how to select, charge and handle, maintain and determine the condition of your batteries. This material, which can increase battery service as much as 50%, is FREE to battery users, without obligation. A request on your letterhead will bring descriptive booklet by return mail.

DAILY RECORD SYSTEM CONTROLS BATTERY MAINTENANCE

Keep a diesel battery and voltage regulator inspection card (like that illustrated below—they're FREE on request) in a holder on each locomotive unit. Identify each battery by serial number and if battery is transferred to another locomotive unit, transfer its record card also. Record pilot cell readings daily. If there is a constant drop of specific gravity, voltage regulator setting should be increased. If there is excessive temperature or water consumption, setting should be decreased. Record regulator settings, and date changes were made. Monthly inspections should be made and all pertinent data recorded. When inspection card is filled, a new one should be made out and all pertinent data including readings from last inspection, recorded on it. The old card should then be placed in a file.



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America's Finest Diesel Starting Batteries

GOULD BATTERY RECORD
DIESEL-ELECTRIC LOCOMOTIVES

MAKE_____ TYPE_____ SERIAL NO._____ LOCO. NO._____

DATE	SPECIFIC GRAVITY	ACID TEMPERATURE	WATER ADDED	GEN. REGULATOR VOLTAGE	
				BEFORE ADJUST.	AFTER ADJUST.

GOULD STORAGE BATTERIES

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, NEW JERSEY

Always Use Gould-National Automobile and Truck Batteries

C. E. MARLEY, general foreman of the Texas & Pacific at Marshall, Tex., has been appointed night foreman at Shreveport La.

E. E. LONG, master mechanic of the Texas & Pacific at Big Spring, Tex., has been appointed assistant superintendent of shops at Marshall, Tex.

L. G. WEBER, erecting shop foreman of the Texas & Pacific at Marshall, Tex., has been appointed enginehouse foreman at Ft. Worth, Tex.

P. A. WARD, machine shop foreman of the New York, Chicago & St. Louis at Brewster, Ohio, has been appointed general foreman at Brewster.

J. D. MOORE, general enginehouse foreman of the Texas & Pacific at Marshall, Tex., has been appointed general foreman at Mineola, Tex.

J. W. CAMERON, general foreman of the New York, Chicago & St. Louis at Brewster, Ohio, has been appointed shop superintendent at Brewster.

F. L. SCARBOROUGH, JR., enginehouse foreman of the Texas & Pacific at Fort Worth, Tex., has been appointed general foreman at Texarkana, Tex.

CARTER E. PARHAM, derrick foreman of the Southern at Asheville, N. C., has been appointed general foreman car repairs.

R. W. SMITH, air brake foreman of the Norfolk & Western at Portsmouth, Ohio, has been appointed assistant enginehouse foreman at Portsmouth.

Obituary

EMIL L. LARSON, former engineer of car design and maintenance of the Chicago, Burlington & Quincy at Chicago, died at Downey, Cal., on July 30. At the time of his death Mr. Larson was with the North American Aviation, Inc., with which firm he had become associated in February, 1951.

RICHARD J. WILLIAMS, who retired as chief mechanical officer of the Chesapeake & Ohio, Pere Marquette district, in 1949, died in Alden, Mich., on August 2.

New Devices

(Continued from page 91)

Struts are joined by integral saddles to create lateral members of great strength.

Material used for its manufacture is sheet steel or aluminum of gauges ranging from 12 to 16.

◆

Non-Slip Work Glove

Reinforced neoprene-coated gloves with a non-slip grip which provides a safe grip, even when handling greasy, slippery parts and materials, have been announced by the Edmont Mfg. Co., Coshocton, Ohio. For hard service in disassembling and assembling work, heavy parts handling, cleaning, degreasing, and painting, these Neox-

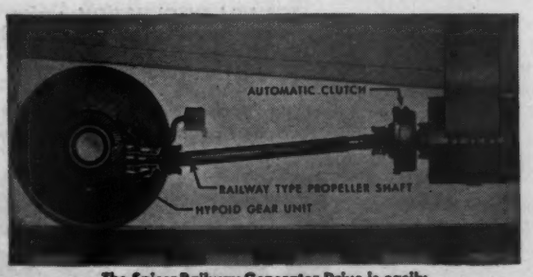
The Delaware and Hudson "Laurentian"

Spicer Generator-Drive Equipped

THE ADIRONDACKS—Lake George—Lake Champlain—Saratoga Springs area is the most readily accessible playground for millions in America. Perfect transportation facilities by "The D & H" lead to this summer paradise from all directions.

The magnificent scenic beauty of this area can be seen from the fast daily daylight "Laurentian" trip between New York and Montreal. The picturesque run is enjoyed from soft reclining-seat coaches in air-conditioned comfort. There is also a streamlined observation-lounge car on the rear of the train. The equipment is modern and all-steel throughout. Excellent meals are served in the well-appointed dining car. The extra-heavy demands for electrical service are amply supplied by Spicer Railway Generator Drives.

An imposing list of America's crack trains and streamliners rely upon Spicer equipment for electrical service of the highest efficiency. Write for literature giving complete details of the Spicer Railway Generator Drive.



The Spicer Railway Generator Drive is easily adaptable to old and new equipment

47 YEARS OF Spicer SERVICE

The Spicer Railway Generator Drive is manufactured, sold and serviced by

SPICER MANUFACTURING
Division of Dana Corporation
TOLEDO 1, OHIO

coated gloves are said to outwear up to 10 pairs of ordinary work gloves.

The extra tough coating is chemically welded to a strong fabric base to achieve protection against greasing and degreasing, acids, caustics, solvents, plus extreme resistance to abrasion and cutting. Seamless wearing surface eliminates splitting.

A wide, naturally-curved thumb span lessens fatigue, and provides a better grip. Its fabric lining prevents snags, absorbs sweat, insulates, makes gloves easy to take on and off.

◆

Hand Tachometer

The Dr. Horn centrifugal hand tachometer which has not been made since the Horn plant in Germany was put out of commission has again been made available by James G. Biddle Co., Philadelphia. The instrument illustrated is an improved type which has six ranges extending from 25 to 30,000 r.p.m. It is protected against damage from overspeeding, and can be operated in a vertical, horizontal or slanting position. It is supplied with a carrying case and accessories. The size of the case is 3½ in. x 2 in. x 6½ in. The weight of the instrument and case with accessories is 1¼ lb. The weight of the instrument only is ¾ lb.

◆

Heavy Duty Electric Nut Runner

A new, heavy duty universal electric Impactool for tough nut running jobs in truck, bus, and maintenance fields has been announced by Ingersoll-Rand Co., New York 4. Known as the size 34U Impactool, it has a 1 in. square driver, and is rated for bolts up to 1¼ in. size.

The unit employs a universal electric motor and an impact unit, placed side by side to reduce overall height, which permits handling truck U-bolt nuts without jacking up the truck. The impact mechanism automatically converts the power of the electric motor to hundreds of rotary impacts whenever sufficient resistance to

Millions made to date—

NOT ONE has ever pulled out!*

We've put Permanently-Sealed shunt connections where they'll do *YOU* the most good—on "National" STANDARDIZED Brushes for diesel-electric traction motors. Available only on the standardized brushes listed below:

NC 24-7215	2 x2¼x¾ (⅜-⅜)	"Plytek" Grade AZY
NC 24-7213	2 x2¼x¾ (⅜-⅜)	"Plytek" Grade AX-5
NC 24-5620	2 x1¾x¾ (⅜-⅜)	"Plytek" Grade AZY
NC 20-6420	2⅛x2 x⅝ ($\frac{5}{16}$-$\frac{5}{16}$)	"Plytek" Grade AZY
NC 20-6419	2⅛x2 x⅝ ($\frac{5}{16}$-$\frac{5}{16}$)	"Plytek" Grade AJH

●

WRITE NATIONAL CARBON COMPANY FOR INFORMATION

It's the NEW NATIONAL TRADE-MARK *Permanently-Sealed Shunt for Diesel-electric traction motor brushes!*

* ACCORDING TO CUSTOMERS' REPORTS AS OF JUNE 26, 1951

●

The terms "National", "Plytek" and the Silver Strand Cable device are trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.

District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

IN CANADA: National Carbon Limited
Montreal, Toronto, Winnipeg

turning is met. The tool is built to handle tough truck and bus nut running jobs such as spring U-bolt work and Budd wheel work.

One piece construction of the motor housing and hammer case provides rigidity and alignment, and at the same time reduces overall weight. Protective skid runners permit sliding the tool around while in use, without fear of damage to the gear case.

The Impactool is only 10 3/16 in. high, 4¾ in. wide, and 14⅛ in. long excluding the adjustable grip handle, which may be attached in any one of three positions, or removed entirely if desired. The other handle with the trigger switch may also be rotated 180°. It weighs 32½ lb. and comes equipped with a heavy duty plug and 3 conductor cable, packed in a metal-edge box.

◆

General Purpose Liquid Cleaner

An odorless general purpose liquid cleaner and sanitizer for industrial use, combining a quaternary ammonium compound and a compatible synthetic detergent is now being manufactured by West Disinfecting Co., Long Island City 1, N. Y.

Known as Sanikleen, this solution is easy to use and permits cleaning and sanitizing in one economical operation. It eliminates the need for an extra, separate sanitizing rinse and therefore makes possible considerable savings in time, labor, and materials.

An equally effective cleanser in hard or soft water, leaving no residual soap film, the liquid can be used for cleaning and sanitizing walls, windows, eating utensils, and floor surfaces of wood, concrete, linoleum, asphalt tile, terrazzo and similar materials. When it is used according to directions, the sanitizing properties of the quaternary ammonium compound ingredient reduce the amount of bacterial contamination to a point considered safe by public health requirements.

Thoroughly tested for toxicity, the odorless solution has been found extremely safe in this respect, making it suitable where low toxicity is a prime consideration. Since the synthetic detergent is almost neutral in pH, the product is less alkaline than comparable soap solutions.

Ony one ounce of Sanikleen is required per gallon of water for general use. Surfaces can be mopped, scrubbed, or brushed with this solution; for extra heavy-duty cleaning the concentration may be increased without fear of damaging surfaces.

◆

Plain Hydraulic Grinding Machine

Several improvements in the 10 in. and 14-L plain hydraulic grinding machines have been announced by Cincinnati Grinders, Incorporated. The principal reason for these design changes was to improve performance and increase operating convenience.

The headstock of these machines has been completely redesigned. It is now powered by a 1-hp. a.c. motor, eliminating the necessity of a d.c. line to the machine; a magnetic brake is built-in; power is

transmitted entirely through V-belts; an eccentric arrangement for the primary countershaft provides a way to adjust belt tension and change the belt on the four step pulley. The bed is 2 in. lower than before; now only 39½ in. from the floor line to the centers. Grinding wheel collets are designed for 12 in. hole wheels, for continued usefulness on smaller machines after outside diameter wears beyond the size for efficient grinding.

Like several other features, the Filmatic bearings for the grinding wheel spindle have been retained. These bearings are self-adjusting for every grinding condition, and according to the company's record, run for years without maintenance.

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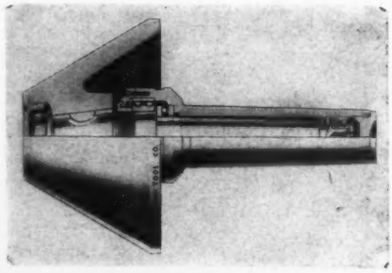


Multi-Purpose Center

The Ready Tool Company, Bridgeport, Conn., has developed a multi-use center. This tool is a bull nose, replaceable point center, so designed that the bull point can be removed quickly and another bull point inserted to accommodate the work—without having to remove the center on the machine.

Naturally, a center of this type is more suited for heavier type of work on tubing or pieces with large center holes and performs at top efficiency on engine lathes, turret lathes or grinding machines. The roller bearing design assures accuracy providing maximum radial and thrust load capacities. The new RED-E-Superaccurate multi-purpose centers are available in any required shank, taper or head size.

◆

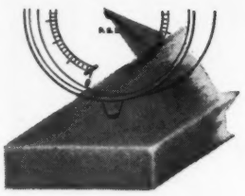
Rust-Proofing Process

Recommended as a replacement for cadmium or zinc in many rust-proofing applications, superior corrosion resistance is credited to Perm-Cote, a new phosphate coating material developed by Detrex Corporation, Detroit 32, Mich.

When immersed in a solution of the material, iron and steel surfaces are chemically converted into a dark gray, uniform, dense, non-metallic phosphate coating. After rinsing, the highly absorbent coating is impregnated with a rust-proofing oil known as Perm-Oil, giving the products a permanent corrosion-proof layer that is dry to the touch.

Typical applications for Perm-Cote are: springs, hand tools, appliances and sheet metal parts.

Beat Pressure...



GUN IRON CAST PARTS

There are three reasons why Gun Iron pressure castings are noted for outstanding service.

Gun Iron is produced by an air furnace process similar to open hearth steel. As a result, its microstructure is dense and close-grained and ideally suited to pressure-type, leak-proof castings . . . a fact proved in countless diesel cylinder heads. In addition, Gun Iron gives a bonus of great resistance to frictional wear, heat, erosion and corrosion.

In Hunt-Spiller's foundry are found the most modern methods and equipment for the production of porosity-free castings of all sizes—with the most intricate coring. And when desired, our extensive manufacturing department can machine the castings to fits and finishes that guarantee fine performance.

Why not investigate Gun Iron for *your* cast parts. Our engineers and laboratories stand ready to help you determine its value. **HUNT-SPILLER MANUFACTURING CORP., 385 Dorchester Ave., Boston 27, Mass.**

Canadian Representatives: Jos. Robb & Co., Ltd., 4050 Namur St., Montreal 16, P.Q.; Export Agents: International Rwy. Supply Co., 30 Church St., N.Y. 7, N.Y.

HERE IS A PRACTICAL GUIDE for the user of iron and steel castings . . . 24 pages of technical data on many types of metals and alloys. Write for your free copy.

Long Life Reflector Lamp

An 800-watt reflector-type lamp, designed to burn for an average of 1,500 hrs., is now being made by the Westinghouse Electric Corporation, Bloomfield, N. J. It is 7½ in. wide, and designed for base-up burning. Light is not emitted through the reflector surface, but only through the lower surface of the lamp and the manufacturer states that this surface is of such a character that it does not readily accumulate dirt. The lamp has a standard mogul screw base and is designed for the replacement of 750-watt, 1,000-hr. lamps.

◆

Aluminum Battery Tray

The K W Battery Company, Chicago, has introduced an aluminum tray for storage batteries. It has the same dimensions as the monobloc container, but adds the service advantage of the hard rubber jar wood tray arrangement, in that only one cell need be changed if there is a leaker. An added feature is a hinged vent cap. This is easy to open, and is closed automatically by the starting motion of the train.